SURVEY OF THE DRIVING NEEDS OF LICENSED DISABLED DRIVERS IN ONTARIO

Executive Summary

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SURVEY OF THE DRIVING NEEDS OF LICENSED DISABLED DRIVERS IN ONTARIO

EXECUTIVE SUMMARY

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Beverley O'Connell of the Human and Social Factors Office conducted the literature search, prepared the bibliography, assisted in coding the questionnaires and provided general assistance to this project.

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We wish to acknowledge those drivers who responded to the questionnaire and to thank them for providing us with an insight into the driving-related needs and concerns of disabled drivers.

EXECUTIVE SUMMARY

OVERVIEW

The purpose of this study was to survey licensed drivers in Ontario who require special driving equipment in order to gain an understanding of their driving-related needs as well as to identify any problems or issues facing the physically disabled driver with respect to vehicle conversions, adaptive driving aids and vehicle design.

A mail survey was conducted in February/March 1986 of all drivers in Ontario who require hand controls (1477) or assorted equipment (64). Within the assorted equipment group are those drivers who require a variety of adaptive driving aids other than hand controls, such as steering spinners, left-side gas pedals and brake extensions. The results of the study are based on the responses of 670 licensed drivers in the hand controls group and 26 drivers in the assorted equipment group, a response rate of 51% and 46%, respectively.

In addition, the same questionnaire was used with a pilot sample of 130 drivers who require automatic transmission and 100 drivers who require outside rear view mirrors to ascertain whether they have special driving needs as well. Pilot test results, based on response rates of 26% and 18%, respectively, are reported separately in Appendix B. The needs expressed by these drivers, for the most part, are not similar to those expressed by drivers who require hand controls or assorted equipment.

The survey focuses on the self-drive option and was designed to obtain a broad perspective on the driving-related needs of disabled drivers. Questions sought general information on demographic, lifestyle and travel patterns and specific information on physical disabilities, and vehicle design, conversions and driving aids. The survey explored level of satisfaction with various aspects related to driving as well as likely interest in a number of self-drive options, including future developments. The results are based on the experiences and views of drivers who are currently licensed to drive with special equipment, and are presented descriptively in terms of the frequency distribution of responses.

In general, the results indicate that the self-drive option is an important consideration to the drivers who are currently licensed to drive with special equipment. The mobility needs of these drivers are similar in some respects to those of the general driving population. On the other hand, these drivers expressed needs that relate to the fact that special equipment and/or vehicle modifications are required to accommodate their specific physical disabilities. The concerns they report in the survey, together with their ratings of the importance of various design considerations, provide clues for developing and improving vehicle options and design. Their expression of likely interest in a number of potential options suggests areas of potential market demand that could be explored. The results also suggest that there is a need for more information related to the many aspects of the self-drive option.

While this survey provides the views on the self-drive option of drivers currently licensed to drive with special equipment, it may also be relevant to the needs of disabled persons who want to drive and could with the appropriate equipment, and to elderly and other drivers who may benefit from the use of special equipment.

HIGHLIGHTS FROM THE RESULTS OF DRIVERS USING HAND CONTROLS

Profile of Driver

- Hand controls are required by those drivers who are unable to operate the brake or gas pedal in the usual fashion due to physical limitations in the use of their legs. The majority of drivers surveyed (91%) report that they have restricted use of both legs primarily due to paraplegia (50%), polio (20%) and quadriplegia (11%). Most (84%) require the use of a wheelchair.

- Approximately 74% of the disabled drivers who responded to this survey are males compared to the 56% of males in the general driving population of Ontario. Another observation is that there is a larger proportion of respondents between 35 and 64 years of age and a smaller proportion in the under 25 age group.

- About 40% of these drivers work full-time and 8% work part-time. Of those who work, 91% are employed outside the home.

The report also provides responses to other questions related to demographic characteristics such as region and location of residence, living arrangement, education and annual household income.

Travel and Transportation Needs

- The majority of respondents own their vehicle and over half share it with others which suggests that vehicles and driving aids need to be designed to facilitate use by both disabled and able-bodied drivers.

- While licensed disabled drivers reported that they choose the self-drive option for the majority of monthly trips, they do use other means of transportation, although on a limited basis, such as special transit and taxi, as well as being vehicle passengers.

- When asked whether driving their own vehicle is necessary, about 70% of respondents indicated that they prefer to drive while 18% indicated that they have no other alternative. About 7% have to drive for their job.

- Strong dissatisfaction was expressed with the enforcement of parking provisions for handicapped drivers; 27% are dissatisfied and 54% are very dissatisfied.

- Approximately 64% of the respondents are satisfied with licensing requirements and procedures and 17% are very satisfied. About 11% expressed some dissatisfaction and 8% did not have an opinion.

- The availability of vehicle insurance is satisfactory to 54% and very satisfactory to 22%; about 20% expressed dissatisfaction.

- With respect to the availability and quality of special driver training and professional assessment of driving abilities, the majority of respondents (53-62%) either had no opinion or replied "not applicable" suggesting that these drivers never received such services. Of those expressing an opinion, more are satisfied with the availability and quality of driver training and professional assessment (27-35%); however, a number expressed dissatisfaction with the quality of these services (11-12%) and especially with their availability (18-19%).

- About 65% of respondents reported satisfaction with provincial licence plates displaying the international symbol of access and 23% indicated that they are not satisfied. The two main reasons for dissatisfaction are that these plates are too easy to obtain and they label the driver as being disabled, thus endangering personal safety.

- About 48% of drivers reported that they are satisfied with special parking permits and 26% indicated that they are dissatisfied. The main reasons for dissatisfaction include: lack of universality, not available in all municipalities, lack of awareness and police still ticketing.

The report provides responses to other questions such as driving experience and driving exposure (e.g. annual mileage).

Description of Current Vehicle

- Most of the respondents in the hand controls group (79%) report that they drive standard production cars. Many of these cars are two-door models (64%). Others drive regular vans (16%), trucks (3%) or mini vans (2%).

- Approximately an equal number of respondents drive a vehicle which is less than 6 years old as drive a vehicle which is over 6 years old. According to Statistics Canada estimates, the average age of vehicles currently driven by the general driving population is 5.8 years for personal-use passenger cars and 6.3 years for personal-use vans and light trucks (Household Surveys Division, personal communication, September 23, 1986).

- Many of the vehicles driven have split bench or bench style front seats (54%) and are equipped with an average of seven factory options.

- The average price paid for a vehicle was approximately $9,785 with reported prices ranging from $100 to $36,000. The largest proportion of respondents (33%) paid between $5,000 and $9,999 for their vehicle. The majority of respondents (75%) did not receive any mobility allowance or financial assistance for the purchase and/or conversion of their vehicle. Of the 146 respondents who reported that they did receive some financial aid, the majority (69%) received

assistance from a government agency. Some made specific reference to the provincial sales tax rebate of 7% of the price paid for a vehicle.

- The average price paid for vehicle insurance in 1985 by drivers requiring hand controls was approximately $579, although reported rates ranged from $170 to $4,400. Based on insurance figures, the average price paid for insurance in 1985 by the general Ontario driving population is estimated to be approximately $461.

- In response to an open-ended question, a small percentage (15%) identified design features that fail to meet their driving needs such as lack of room behind the driver's seat often resulting in torn upholstery from stowing a wheelchair in the back seat (15); foot-operated controls (e.g. dimmer switch) (10); and poor location of secondary controls such as windshield wipers, and headlights (10).

Responses to questions concerning vehicle make and year, type of van side doors and specific factory options are also addressed in the report.

Vehicle Conversions

- A total of 55 respondents (9%) reported that their vehicles have been structurally converted in one or more of the following ways: raised roof (66%), power pan (15%), wheelchair channels (15%), raised side door (11%) and dropped floor (4%).

- The majority of vehicles (93%) were converted in Ontario, over one-third in the Toronto area. Another 8% were converted in the United States. While most (76%) were converted by companies specializing in conversions, others were converted by dealerships (15%), licensed auto mechanics (8%), and personal contacts (6%).

- Most vehicles (79%) were new when they were structurally converted.

- The average price paid to have the vehicle converted was approximately $7,000 with prices ranging from $300 to $25,000. Twenty-seven drivers (50%) received some financial assistance, the majority (78%) from a government source such as the Workers' Compensation Board, Department of Veteran Affairs and the provincial sales tax rebate on the purchase of a vehicle.

- Respondents reported problems with the following: raised roof (5), power pan (3), wheel channels (3) and raised side door (2).

- When asked for their perception of the safety of the conversion, most respondents (92%) expressed satisfaction.

- In decreasing order of satisfaction, the percentage of respondents who expressed satisfaction as compared to dissatisfaction is:

  - quality of conversion (79% versus 20%);
  - service/maintenance (73% versus 23%);
  - time to arrange conversion (54% versus 40%); and
  - time required to complete structural conversion (51% versus 41%).

- Strong dissatisfaction was expressed with the availability of contractors (61%), the availability of information on vehicle conversions (60%) and the cost of the structural conversion (59%).

Adaptive Driving Aids

- The adaptive driving aids used include: acceleration/braking aids (608) such as hand controls and parking brake extensions; vision aids (344) such as full range rear view mirror; safety aids (234) such as wheelchair restraints; steering aids (205) such as steering spinners; control lever aids (200) such as remote dimmer switch; and entry/exit aids (166) such as automatic lifts and doors.

- The driving aids for which problems were most frequently noted include: hand controls (68); automatic lifts (30); steering spinners (23); automatic doors (22); safety torso restraints/chest harness (21); and right side-mounted convex rear view mirrors (14). In many cases, respondents reported that problems are due to equipment failure.

- The average price paid by drivers in the hand controls group for adaptive driving aids was $985 with reported prices ranging from $5 to $20,000. The largest percentage (46%) paid between $251 and $500.

- The majority (76%) purchased their aids in Ontario, the largest proportion (39%) in Toronto; however, a number (13%) purchased aids from other provinces, primarily British Columbia (10%). Another 12% purchased driving aids from the United States.

- Adaptive driving aids were installed by vendors (37%), licensed auto mechanics (31%), personal contacts (20%), equipment manufacturers (8%) and drivers themselves (10%).

- When asked for their level of satisfaction, respondents reported that they are highly satisfied with the safety of adaptive driving aids (93%) and the quality of installation (90%).

- In decreasing order of satisfaction, the percentage of respondents who are satisfied as compared to dissatisfied is:

  - service/maintenance (75% versus 15%);
  - time taken for installation (74% versus 16%); and
  - time required to arrange installation (67% versus 19%).

- Respondents are highly dissatisfied with the availability of information on adaptive driving aids (50%), the cost (49%) and the number of available qualified installers (47%).

- Approximately 109 respondents (18%) reported that they are lacking special equipment that could help with their driving because the cost is too high, naming such equipment as: factory options (30%), wheelchair lift (15%), mobile telephone (8%) and hand controls (6%).

The report provides further information on respondents' views about disassembling and reusing adaptive driving aids; sources of information on conversions and driving aids; and suggestions for changes or improvements in vehicle design, structural conversions and adaptive driving aids.

Future Vehicular Needs

- About 44% of respondents indicated that they would be in the market to buy a new vehicle within the next two years and provided a range of prices that they might be willing to pay for their next vehicle.

- When provided with a list of 8 vehicle design features, respondents indicated the following to be the most important when choosing another vehicle: ease of entry/exit (73%), followed by size of vehicle (42%), head and leg room (36%), wide doors (32%), seats (32%), appearance (30%), accessible storage space (22%) and height of vehicle (15%).

- Of the 541 respondents who use wheelchairs, 29% reported that they might be willing to pay an additional amount to have a car which can be driven from a wheelchair and to which level access is possible without the use of a lift.

- Approximately 33% of the 541 respondents who use wheelchairs, reported that they might be willing to pay an additional amount for a van which can be driven from a wheelchair and to which level access is possible without the use of a lift or the need for a raised roof.

- Slightly over half of the total respondents (51%) indicated that they would prefer an intermediate or large size car for their next vehicle while others expressed a preference for vehicles such as a regular van (20%), a mini van (13%), compact car (11%) and subcompact car (3%).

- A strong interest was expressed by 70% of respondents in owning a vehicle that would meet their driving needs and would not be recognized as a vehicle for disabled drivers.

- While 61% of respondents reported that they are not interested in the potential option of an electric car for local urban use, 23% expressed interest and 10% indicated that they are very interested.

- Seventy-eight percent of respondents indicated that they are not interested in the option of shared ownership of a vehicle while 16% expressed an interest.

- Approximately 51% of respondents reported that they are not interested in renting or leasing a vehicle adapted to meet their needs, 24% are interested and 19% are very interested.

The report provides a summary of reported preferences for a number of vehicle features including number of doors, type of van side doors, type of driver's seat, factory options, adaptive driving aids and vehicle conversions.

Other Comments

The report includes suggestions for improvement, provided by the respondents in response to an open-ended question at the end of the questionnaire.

HIGHLIGHTS FROM THE RESULTS OF DRIVERS REQUIRING ASSORTED EQUIPMENT

Responses to the survey were received from 26 respondents who require assorted driving equipment, a limited number due to the small population (64) of drivers identified with this licence restriction. The results suggest that the travel and transportation needs of respondents who require assorted equipment and those who require hand controls are similar as is their assessment of driving-related needs. Several common issues were identified including issues related to parking provisions, problems with adaptive driving aids, lack of qualified installers, and lack of information on adaptive driving aids.

Differences were apparent in the selection of a vehicle and associated design features, and in the range of adaptive driving aids used. These differences are likely attributable to differences in the nature and extent of the disabilities affecting these drivers. Only those results that indicate differences are highlighted below.

Profile of Driver

- The main disabilities reported by the 26 respondents are amputation (8), shortness of body or limbs (8) and back/spine impairment (5). Most of the respondents (20) have restricted use of their lower body; however, for many (15) only one leg is affected. Respondents reported using assistive devices such as canes, leg/foot brace, leg or foot prosthesis, crutches and special shoes; no one reported using a wheelchair. Upper body limitations, due mainly to paralysis and amputation, were reported by 14 respondents.

Description of Current Vehicle

- The cars driven by respondents are mainly four-door models (17) with bucket seats (14).

- Of the 12 respondents who identified vehicle design features which fail to meet their driving needs, 6 noted the poor location of secondary controls.

Vehicle Conversions

- None of the respondents reported structural conversions.

Adaptive Driving Aids

- Eighteen of the 26 respondents use acceleration/braking aids, 13 use steering aids, 7 use vision aids, 6 use safety aids, 5 use control lever aids and 3 use entry/exit aids.

- The average price paid for adaptive driving aids by drivers in the assorted equipment group was approximately $105, with prices ranging from $15 to $500.

Future Vehicular Needs

- An intermediate size car was chosen as the preferred size by 9 respondents, followed by a compact car (8).

- From a list of 8 design features, respondents selected the following as being the most important: size of vehicle (15); ease of entry/exit (14); seats (11); head and leg room (9); and appearance (7).

PILOT STUDY

A pilot study was conducted using the same questionnaire that was sent to drivers requiring hand controls and assorted equipment. Questionnaires were sent to a sample of 130 drivers requiring automatic transmission and 100 drivers requiring outside rear view mirrors in order to determine whether these drivers have special driving needs.

The response rate was 26% for the automatic transmission sample and 18% for the outside rear view mirrors sample. The lower response rates may be due to the fact that the questionnaire covered a broad range of disabilities and special equipment which many did not find relevant to them. A different questionnaire would need to be developed to carry out a full study of these groups. However, some information was obtained in this pilot study as a number of respondents reported using driving aids in addition to the equipment required by their licence restriction.

Automatic Transmission Sample

- Twenty-seven respondents reported having one or more of the following disabilities: amputation (14), polio (7), stiff joints (6), arthritis (5), shortness of body or limbs (2), heart condition (1), paraplegia (1), and a back/spine impairment (1). The adaptive driving aids reported to be used by these drivers include: left-foot gas pedal, hand controls, left convex rear view mirror, right convex rear view mirror, full range rear view mirror, dual mirrors, torso restraint/chest harness, two-way radio, fire extinguisher, remote dimmer switch, remote controls and steering column adjuster.

Outside Rear View Mirror Sample

- Thirteen of the 15 respondents reported being hard of hearing while two respondents reported having arthritis and/or a back impairment. Adaptive driving aids reported to be used include: left convex rear view mirror, right convex rear view mirror, full range rear view mirror, dual mirrors, right side turn signal, remote controls, remote dimmer switch and torso restraint/chest harness.

Implications

- There are currently 2,126 drivers in Ontario who require automatic transmission and 727 who require outside rear-view mirrors. In order to obtain a better understanding of the needs of these two groups, especially the automatic transmission group who require a range of equipment for a number of disabilities, a questionnaire designed to address their needs would be required.

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* Based on this work, The Transportation Development Centre has recently published a consumer or buyer's guide entitled "Vehicles and Adaptive Aids for Elderly and Diabled Drivers" (Cat. No. T48-25-1986E; ISBN:0-660-11937-4) which is available with a charge from the Canadian Government Publishing Centre, Ottawa, Canada K1A 0S9 (telephone: (819) 997-2560).

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EXECUTIVE SUMMARY

OVERVIEW

The purpose of this study was to survey licensed drivers in Ontario who require special driving equipment in order to gain an understanding of their driving-related needs as well as to identify any problems or issues facing the physically disabled driver with respect to vehicle conversions, adaptive driving aids and vehicle design.

A mail survey was conducted in February/March 1986 of all drivers in Ontario who require hand controls (1477) or assorted equipment (64). Within the assorted equipment group are those drivers who require a variety of adaptive driving aids other than hand controls, such as steering spinners, left-side gas pedals and brake extensions. The results of the study are based on the responses of 670 licensed drivers in the hand controls group and 26 drivers in the assorted equipment group, a response rate of 51% and 46%, respectively.

In addition, the same questionnaire was used with a pilot sample of 130 drivers who require automatic transmission and 100 drivers who require outside rear view mirrors to ascertain whether they have special driving needs as well. Pilot test results, based on response rates of 26% and 18%, respectively, are reported separately in Appendix B. The needs expressed by these drivers, for the most part, are not similar to those expressed by drivers who require hand controls or assorted equipment.

The survey focuses on the self-drive option and was designed to obtain a broad perspective on the driving-related needs of disabled drivers. Questions sought general information on demographic, lifestyle and travel patterns and specific information on physical disabilities, and vehicle design, conversions and driving aids. The survey explored level of satisfaction with various aspects related to driving as well as likely interest in a number of self-drive options, including future developments. The results are based on the experiences and views of drivers who are currently licensed to drive with special equipment, and are presented descriptively in terms of the frequency distribution of responses.

In general, the results indicate that the self-drive option is an important consideration to the drivers who are currently licensed to drive with special equipment. The mobility needs of these drivers are similar in some respects to those of the general driving population. On the other hand, these drivers expressed needs that relate to the fact that special equipment and/or vehicle modifications are required to accommodate their specific physical disabilities. The concerns they report in the survey, together with their ratings of the importance of various design considerations, provide clues for developing and improving vehicle options and design. Their expression of likely interest in a number of potential options suggests areas of potential market demand that could be explored. The results also suggest that there is a need for more information related to the many aspects of the self-drive option.

While this survey provides the views on the self-drive option of drivers currently licensed to drive with special equipment, it may also be relevant to the needs of disabled persons who want to drive and could with the appropriate equipment, and to elderly and other drivers who may benefit from the use of special equipment.

HIGHLIGHTS FROM THE RESULTS OF DRIVERS USING HAND CONTROLS

Profile of Driver

- Hand controls are required by those drivers who are unable to operate the brake or gas pedal in the usual fashion due to physical limitations in the use of their legs. The majority of drivers surveyed (91%) report that they have restricted use of both legs primarily due to paraplegia (50%), polio (20%) and quadriplegia (11%). Most (84%) require the use of a wheelchair.

- Approximately 74% of the disabled drivers who responded to this survey are males compared to the 56% of males in the general driving population of Ontario. Another observation is that there is a larger proportion of respondents between 35 and 64 years of age and a smaller proportion in the under 25 age group.

- About 40% of these drivers work full-time and 8% work part-time. Of those who work, 91% are employed outside the home.

The report also provides responses to other questions related to demographic characteristics such as region and location of residence, living arrangement, education and annual household income.

Travel and Transportation Needs

- The majority of respondents own their vehicle and over half share it with others which suggests that vehicles and driving aids need to be designed to facilitate use by both disabled and able-bodied drivers.

- While licensed disabled drivers reported that they choose the self-drive option for the majority of monthly trips, they do use other means of transportation, although on a limited basis, such as special transit and taxi, as well as being vehicle passengers.

- When asked whether driving their own vehicle is necessary, about 70% of respondents indicated that they prefer to drive while 18% indicated that they have no other alternative. About 7% have to drive for their job.

- Strong dissatisfaction was expressed with the enforcement of parking provisions for handicapped drivers; 27% are dissatisfied and 54% are very dissatisfied.

- Approximately 64% of the respondents are satisfied with licensing requirements and procedures and 17% are very satisfied. About 11% expressed some dissatisfaction and 8% did not have an opinion.

- The availability of vehicle insurance is satisfactory to 54% and very satisfactory to 22%; about 20% expressed dissatisfaction.

- With respect to the availability and quality of special driver training and professional assessment of driving abilities, the majority of respondents (53-62%) either had no opinion or replied "not applicable" suggesting that these drivers never received such services. Of those expressing an opinion, more are satisfied with the availability and quality of driver training and professional assessment (27-35%); however, a number expressed dissatisfaction with the quality of these services (11-12%) and especially with their availability (18-19%).

- About 65% of respondents reported satisfaction with provincial licence plates displaying the international symbol of access and 23% indicated that they are not satisfied. The two main reasons for dissatisfaction are that these plates are too easy to obtain and they label the driver as being disabled, thus endangering personal safety.

- About 48% of drivers reported that they are satisfied with special parking permits and 26% indicated that they are dissatisfied. The main reasons for dissatisfaction include: lack of universality, not available in all municipalities, lack of awareness and police still ticketing.

The report provides responses to other questions such as driving experience and driving exposure (e.g. annual mileage).

Description of Current Vehicle

- Most of the respondents in the hand controls group (79%) report that they drive standard production cars. Many of these cars are two-door models (64%). Others drive regular vans (16%), trucks (3%) or mini vans (2%).

- Approximately an equal number of respondents drive a vehicle which is less than 6 years old as drive a vehicle which is over 6 years old. According to Statistics Canada estimates, the average age of vehicles currently driven by the general driving population is 5.8 years for personal-use passenger cars and 6.3 years for personal-use vans and light trucks (Household Surveys Division, personal communication, September 23, 1986).

- Many of the vehicles driven have split bench or bench style front seats (54%) and are equipped with an average of seven factory options.

- The average price paid for a vehicle was approximately $9,785 with reported prices ranging from $100 to $36,000. The largest proportion of respondents (33%) paid between $5,000 and $9,999 for their vehicle. The majority of respondents (75%) did not receive any mobility allowance or financial assistance for the purchase and/or conversion of their vehicle. Of the 146 respondents who reported that they did receive some financial aid, the majority (69%) received

assistance from a government agency. Some made specific reference to the provincial sales tax rebate of 7% of the price paid for a vehicle.

- The average price paid for vehicle insurance in 1985 by drivers requiring hand controls was approximately $579, although reported rates ranged from $170 to $4,400. Based on insurance figures, the average price paid for insurance in 1985 by the general Ontario driving population is estimated to be approximately $461.

- In response to an open-ended question, a small percentage (15%) identified design features that fail to meet their driving needs such as lack of room behind the driver's seat often resulting in torn upholstery from stowing a wheelchair in the back seat (15); foot-operated controls (e.g. dimmer switch) (10); and poor location of secondary controls such as windshield wipers, and headlights (10).

Responses to questions concerning vehicle make and year, type of van side doors and specific factory options are also addressed in the report.

Vehicle Conversions

- A total of 55 respondents (9%) reported that their vehicles have been structurally converted in one or more of the following ways: raised roof (66%), power pan (15%), wheelchair channels (15%), raised side door (11%) and dropped floor (4%).

- The majority of vehicles (93%) were converted in Ontario, over one-third in the Toronto area. Another 8% were converted in the United States. While most (76%) were converted by companies specializing in conversions, others were converted by dealerships (15%), licensed auto mechanics (8%), and personal contacts (6%).

- Most vehicles (79%) were new when they were structurally converted.

- The average price paid to have the vehicle converted was approximately $7,000 with prices ranging from $300 to $25,000. Twenty-seven drivers (50%) received some financial assistance, the majority (78%) from a government source such as the Workers' Compensation Board, Department of Veteran Affairs and the provincial sales tax rebate on the purchase of a vehicle.

- Respondents reported problems with the following: raised roof (5), power pan (3), wheel channels (3) and raised side door (2).

- When asked for their perception of the safety of the conversion, most respondents (92%) expressed satisfaction.

- In decreasing order of satisfaction, the percentage of respondents who expressed satisfaction as compared to dissatisfaction is:

  - quality of conversion (79% versus 20%);
  - service/maintenance (73% versus 23%);
  - time to arrange conversion (54% versus 40%); and
  - time required to complete structural conversion (51% versus 41%).

- Strong dissatisfaction was expressed with the availability of contractors (61%), the availability of information on vehicle conversions (60%) and the cost of the structural conversion (59%).

Adaptive Driving Aids

- The adaptive driving aids used include: acceleration/braking aids (608) such as hand controls and parking brake extensions; vision aids (344) such as full range rear view mirror; safety aids (234) such as wheelchair restraints; steering aids (205) such as steering spinners; control lever aids (200) such as remote dimmer switch; and entry/exit aids (166) such as automatic lifts and doors.

- The driving aids for which problems were most frequently noted include: hand controls (68); automatic lifts (30); steering spinners (23); automatic doors (22); safety torso restraints/chest harness (21); and right side-mounted convex rear view mirrors (14). In many cases, respondents reported that problems are due to equipment failure.

- The average price paid by drivers in the hand controls group for adaptive driving aids was $985 with reported prices ranging from $5 to $20,000. The largest percentage (46%) paid between $251 and $500.

- The majority (76%) purchased their aids in Ontario, the largest proportion (39%) in Toronto; however, a number (13%) purchased aids from other provinces, primarily British Columbia (10%). Another 12% purchased driving aids from the United States.

- Adaptive driving aids were installed by vendors (37%), licensed auto mechanics (31%), personal contacts (20%), equipment manufacturers (8%) and drivers themselves (10%).

- When asked for their level of satisfaction, respondents reported that they are highly satisfied with the safety of adaptive driving aids (93%) and the quality of installation (90%).

- In decreasing order of satisfaction, the percentage of respondents who are satisfied as compared to dissatisfied is:

  - service/maintenance (75% versus 15%);
  - time taken for installation (74% versus 16%); and
  - time required to arrange installation (67% versus 19%).

- Respondents are highly dissatisfied with the availability of information on adaptive driving aids (50%), the cost (49%) and the number of available qualified installers (47%).

- Approximately 109 respondents (18%) reported that they are lacking special equipment that could help with their driving because the cost is too high, naming such equipment as: factory options (30%), wheelchair lift (15%), mobile telephone (8%) and hand controls (6%).

The report provides further information on respondents' views about disassembling and reusing adaptive driving aids; sources of information on conversions and driving aids; and suggestions for changes or improvements in vehicle design, structural conversions and adaptive driving aids.

Future Vehicular Needs

- About 44% of respondents indicated that they would be in the market to buy a new vehicle within the next two years and provided a range of prices that they might be willing to pay for their next vehicle.

- When provided with a list of 8 vehicle design features, respondents indicated the following to be the most important when choosing another vehicle: ease of entry/exit (73%), followed by size of vehicle (42%), head and leg room (36%), wide doors (32%), seats (32%), appearance (30%), accessible storage space (22%) and height of vehicle (15%).

- Of the 541 respondents who use wheelchairs, 29% reported that they might be willing to pay an additional amount to have a car which can be driven from a wheelchair and to which level access is possible without the use of a lift.

- Approximately 33% of the 541 respondents who use wheelchairs, reported that they might be willing to pay an additional amount for a van which can be driven from a wheelchair and to which level access is possible without the use of a lift or the need for a raised roof.

- Slightly over half of the total respondents (51%) indicated that they would prefer an intermediate or large size car for their next vehicle while others expressed a preference for vehicles such as a regular van (20%), a mini van (13%), compact car (11%) and subcompact car (3%).

- A strong interest was expressed by 70% of respondents in owning a vehicle that would meet their driving needs and would not be recognized as a vehicle for disabled drivers.

- While 61% of respondents reported that they are not interested in the potential option of an electric car for local urban use, 23% expressed interest and 10% indicated that they are very interested.

- Seventy-eight percent of respondents indicated that they are not interested in the option of shared ownership of a vehicle while 16% expressed an interest.

- Approximately 51% of respondents reported that they are not interested in renting or leasing a vehicle adapted to meet their needs, 24% are interested and 19% are very interested.

The report provides a summary of reported preferences for a number of vehicle features including number of doors, type of van side doors, type of driver's seat, factory options, adaptive driving aids and vehicle conversions.

Other Comments

The report includes suggestions for improvement, provided by the respondents in response to an open-ended question at the end of the questionnaire.

HIGHLIGHTS FROM THE RESULTS OF DRIVERS REQUIRING ASSORTED EQUIPMENT

Responses to the survey were received from 26 respondents who require assorted driving equipment, a limited number due to the small population (64) of drivers identified with this licence restriction. The results suggest that the travel and transportation needs of respondents who require assorted equipment and those who require hand controls are similar as is their assessment of driving-related needs. Several common issues were identified including issues related to parking provisions, problems with adaptive driving aids, lack of qualified installers, and lack of information on adaptive driving aids.

Differences were apparent in the selection of a vehicle and associated design features, and in the range of adaptive driving aids used. These differences are likely attributable to differences in the nature and extent of the disabilities affecting these drivers. Only those results that indicate differences are highlighted below.

Profile of Driver

- The main disabilities reported by the 26 respondents are amputation (8), shortness of body or limbs (8) and back/spine impairment (5). Most of the respondents (20) have restricted use of their lower body; however, for many (15) only one leg is affected. Respondents reported using assistive devices such as canes, leg/foot brace, leg or foot prosthesis, crutches and special shoes; no one reported using a wheelchair. Upper body limitations, due mainly to paralysis and amputation, were reported by 14 respondents.

Description of Current Vehicle

- The cars driven by respondents are mainly four-door models (17) with bucket seats (14).
- Of the 12 respondents who identified vehicle design features which fail to meet their driving needs, 6 noted the poor location of secondary controls.

Vehicle Conversions

- None of the respondents reported structural conversions.

Adaptive Driving Aids

- Eighteen of the 26 respondents use acceleration/braking aids, 13 use steering aids, 7 use vision aids, 6 use safety aids, 5 use control lever aids and 3 use entry/exit aids.
- The average price paid for adaptive driving aids by drivers in the assorted equipment group was approximately $105, with prices ranging from $15 to $500.

Future Vehicular Needs

- An intermediate size car was chosen as the preferred size by 9 respondents, followed by a compact car (8).
- From a list of 8 design features, respondents selected the following as being the most important: size of vehicle (15); ease of entry/exit (14); seats (11); head and leg room (9); and appearance (7).

PILOT STUDY

A pilot study was conducted using the same questionnaire that was sent to drivers requiring hand controls and assorted equipment. Questionnaires were sent to a sample of 130 drivers requiring automatic transmission and 100 drivers requiring outside rear view mirrors in order to determine whether these drivers have special driving needs.

The response rate was 26% for the automatic transmission sample and 18% for the outside rear view mirrors sample. The lower response rates may be due to the fact that the questionnaire covered a broad range of disabilities and special equipment which many did not find relevant to them. A different questionnaire would need to be developed to carry out a full study of these groups. However, some information was obtained in this pilot study as a number of respondents reported using driving aids in addition to the equipment required by their licence restriction.

Automatic Transmission Sample

- Twenty-seven respondents reported having one or more of the following disabilities: amputation (14), polio (7), stiff joints (6), arthritis (5), shortness of body or limbs (2), heart condition (1), paraplegia (1), and a back/spine impairment (1). The adaptive driving aids reported to be used by these drivers include: left-foot gas pedal, hand controls, left convex rear view mirror, right convex rear view mirror, full range rear view mirror, dual mirrors, torso restraint/chest harness, two-way radio, fire extinguisher, remote dimmer switch, remote controls and steering column adjuster.

Outside Rear View Mirror Sample

- Thirteen of the 15 respondents reported being hard of hearing while two respondents reported having arthritis and/or a back impairment. Adaptive driving aids reported to be used include: left convex rear view mirror, right convex rear view mirror, full range rear view mirror, dual mirrors, right side turn signal, remote controls, remote dimmer switch and torso restraint/chest harness.

Implications

- There are currently 2,126 drivers in Ontario who require automatic transmission and 727 who require outside rear-view mirrors. In order to obtain a better understanding of the needs of these two groups, especially the automatic transmission group who require a range of equipment for a number of disabilities, a questionnaire designed to address their needs would be required.

1. INTRODUCTION

In recent years there has been increasing emphasis on improving the mobility of physically disabled persons. The focus of this work has been directed primarily at public transportation and accessibility. This has resulted in the development of standards for transporting disabled persons on public transportation, in particular, on buses and trains.

Much less attention has been paid to the self-drive option for disabled persons, although there is a growing body of publications and organizations interested in this area. The automobile is the preferred mode of transportation for most people whether disabled or not. To the physically disabled person, however, the ability to drive not only enhances independence and freedom but increases employment, educational and social interaction opportunities. For many, the option to drive significantly reduces the effort and discomfort associated with travel. The self-drive option is a valued resource and access to it should certainly receive more attention.

Advancements in technology have enabled people with a wide range of disabilities and physical limitations to drive. Equipment ranging from simple steering aids to complete systems for the manual operation of brakes and acceleration has been developed so that even severely disabled individuals are able to drive themselves. These developments are largely the result of private enterprise's response to a perceived market demand.

In light of the increasing number of vehicle conversions and adaptive driving aids on the market, this ministry recognizes the need to support the development and improvement of technical and safety standards. To do this requires a fuller understanding of the driving equipment currently used, the problems experienced by users and the number of persons affected. Many other important questions need to be addressed with respect to the self-drive option. For example, are the driving needs of the disabled population being met? Do barriers to access exist as a result of lack of financial resources? How many people are currently benefiting from the use of special equipment and how many others could benefit from its use?

This study was commissioned by the Transportation Regulation Operations Division of the Ontario Ministry of Transportation and Communications as one step in the direction of seeking answers to these questions. The study examines the driving needs and experiences of licensed disabled drivers and obtains their assessment of vehicle conversions, adaptive driving aids and vehicle design. It is expected that any insights provided for future improvements in the design of vehicles and driving equipment to meet the needs of disabled drivers will likely benefit elderly and other drivers as well.

1.1 Background

The issues of technical standards, safety standards and accessibility are being addressed by many jurisdictions. Representatives from this ministry are involved in a number of committees addressing the self-drive option, including committees of the Canadian Conference of Motor Transport

Administrators and interministerial groups. This ministry is also working with local vehicle conversion shops in an effort to support the development of special vehicles suited to driving from wheelchairs.

In other jurisdictions, the Transportation Development Centre of Transport Canada commissioned James Hickling Management Consultants Limited (1985) to examine present technology and to provide a report detailing vehicle selection guidelines for elderly and disabled persons. The report recommends adaptive driving aids for a variety of physical limitations, lists the names of manufacturers of adaptive driving aids, and provides a province-by-province directory of sources for financial assistance.

At the request of the National Institute for Handicapped Research in the U.S.A., the Adaptive Devices Subcommittee of the Human Factors Engineering Office of the Society of Automotive Engineers was formed recently to deal with: standard terminology and definitions; restraints and tie-down systems for wheelchairs; structural modifications; access systems; and quality control.

A task force struck by the Office of Vocational Rehabilitation in Pennsylvania met from October 1984 to February 1985 to develop a policy governing driver evaluation, driver training and vehicle modifications. The recommendations of this task force highlight the need to: standardize driver evaluation and equipment prescription formats; develop universal terminology for vehicle modification; develop a system of vendor certification; examine the competitive bidding process of vendors; develop policy for implementing quality control procedures; and develop recommendations on services required to govern the conversion of a client's existing vehicle or a used vehicle.

1.2 Literature Review

In order to provide background information for the development of the questionnaire, a literature review was undertaken using sources such as the National Technical Information Service and the Highway Research Information Service to identify relevant material. Information was collected on a variety of topics, including: demographic characteristics of the disabled population; general driving-related needs; adaptive driving aids; vehicle conversions; and vehicle design. The articles that were used are listed in the reference and bibliography sections of this report. Some of the main findings are summarized below.

1.2.1 Demographic Information

In reviewing the literature, the most significant finding was the lack of reliable data on the number and characteristics of disabled persons. Few estimates of the size of the disabled population are available and those figures that are must be used with caution. These estimates have been derived from studies such as the U.S. health interview survey or studies carried out in very localized areas in Canada. The questions used to determine disability vary from study to study, as do the definitions of disability. In the Transportation Development Centre study referred to earlier, an attempt was made to define and estimate the size of the

driving-disabled group in Canada based primarily on the U.S. health survey and Transport Canada's data base on transportation-handicapped people. The driving-disabled was defined to be "any person who has a functional impairment that limits his ability to drive." Not included are those disabled persons who would not likely benefit from special equipment and those who are prevented from driving due to other reasons, such as preference or illness. The total Canadian driving-disabled group, aged 20 and over who are not living in institutions, was estimated to be 1.95 million people, comprising in decreasing order of needs:

- 225,000 who are prevented from driving due to health or disability but could drive with special equipment and design awareness;
- 15,000 who are driving now with special equipment;
- 410,000 current drivers who do not use but would benefit from special or improved equipment; and
- 1,300,000 current non-disabled drivers who do not use special equipment now but would benefit from better awareness of design options.

Data which was collected as a supplement to the Canadian Labour Force Survey (October 1983 - June 1984) by Statistics Canada and presented in The Canadian Health and Disability Survey (June 1985), provide further estimates of the number and demographic characteristics of physically disabled people in Canada, on both a national and provincial level.

Respondents were considered to have some degree of disability if they had trouble performing any one of the 17 activities identified as part of daily living (i.e. walking up or down a flight of stairs) or if they experienced limitations in the kind or amount of activity they could do at home, work or school as a result of a long term physical/health problem or mental handicap. Those persons disabled due solely to mental illness were excluded from the target group.

Findings for Ontario suggest that the most common disability is one related to mobility, as shown below. Over 60% of the surveyed disabled population reported mobility-related disabilities.

TYPE OF DISABILITY REPORTED	ESTIMATED DISABLED POPULATION IN ONTARIO (15 years and over, in 000's)	
	#	%
Mobility	622	63.6
Hearing	119	12.2
Seeing	237	24.2
	978	100.0

According to this ministry's 1984 licensing records, approximately 6,000 drivers in Ontario required special driving equipment indicating that slightly less than 1% (0.8%) of the estimated mobility and hearing-disabled population in Ontario is licensed to drive.

1.2.2 General Driving Needs

The literature review also revealed that very few studies have attempted to obtain a user's perspective of driving-related needs. Studies that have sought the opinions of disabled drivers consistently report that very few problems are experienced with the road system itself and that parking, for example, poses many difficulties.

Findings from previous research indicate a need to:

- provide more reserved parking spaces for the handicapped;
- enforce provisions of reserved parking;
- locate reserved parking spaces in more accessible locations;
- widen parking spaces;
- educate the general public on the meaning and importance of reserved parking spaces for the handicapped;
- educate the general public on the fact that disabled persons can and do drive safely;
- educate insurance companies on the overall safe driving records of the disabled driving population;
- better disseminate information about driving aids;
- develop sources for financial assistance; and
- promote disabled persons to rental agencies to encourage them to make hand controls available on rental vehicles.

1.2.3 Adaptive Driving Aids

Problems with adapative driving aids that have been highlighted in the literature can be summarized as follows: equipment failures such as part detachment, part breakage and electrical wiring; operational concerns such as the problem of simultaneous braking and acceleration with hand controls; problems associated with the use of secondary controls since the hands must be removed from hand controls to operate windshield wipers, horn, etc.; equipment/body interference; and limited availability of installation and maintenance services.

1.2.4 Structural Conversions to Vehicles

Drivers who are unable to transfer from a wheelchair to a car seat will often select a van, a vehicle which will allow them to drive from their wheelchair. However, vehicle conversions involving structural modifications are usually required. If, for example, a driver's view is obstructed by the roof line of a van, the van must be structurally modified by lowering the floor or by installing a power pan or wheel channels. For the disabled person who sits high in the chair, it may be necessary to raise the roof of the van as well as the side doors to facilitate entry/exit via a wheelchair lift. Safety has been the main subject of articles dealing with vehicle conversions.

1.2.5 Vehicle Design

Several studies which address the subject of vehicle design have documented the following problems:

- access to front and rear seats;
- lack of room behind the driver's seat for a wheelchair;
- stowage problems related to unsuitable trunk shape and/or volume;
- seats which are too low;
- door openings which are not wide enough; and
- operational and manipulative difficulties, for example, reaching and closing door, operating door latch, adjusting seat position, reaching for dashboard controls, and reaching seat belts.

The selection of an intermediate or large size vehicle is generally recommended to facilitate entry and access, and for the extra room required to accommodate adaptive driving aids. The two-door sedan, which provides the greatest amount of room between the door post and the back of the driver's seat for stowage of a wheelchair, is considered to be the most appropriate choice. Individuals who have the use of their upper extremities often prefer the two-door sedan to a van because of the costs involved in equipment adaptations and structural modifications.

Recommended factory options vary according to disability, however, the following options are the most frequently recommended: automatic transmission, power steering and brakes, power seats, adjustable (tilt) steering wheel, bench or split bench front seat to facilitate ease of entry and exit, air conditioning (medical necessity for some), remote adjustable outside mirrors, and rear window defroster. Other suggested options which could benefit the driver are: power windows, power door locks and power trunk/hatch release.

2. DESCRIPTION OF SURVEY

2.1 Survey Objective

The main objective of this study is to obtain a better understanding of the driving-related needs of disabled drivers and to identify the issues and concerns users of special equipment have with respect to vehicle conversions, adaptive driving aids and vehicle design.

2.2 Target Groups

In order to fulfill the objectives of this survey, Ontario drivers who have licence restrictions as a result of a physical disability were identified through this ministry's driver licensing records. Restrictions vary with the nature of the disability and are limited to those necessary to insure the safety of the driver. The licence restrictions identified pertain to one of four equipment categories: hand controls, assorted equipment, automatic transmission and outside rear view mirrors. The survey was directed at drivers in the first two categories; at the same time a pilot test using the same questionnaire was carried out with drivers, in the other two categories, who require automatic transmission and rear view mirrors.

2.2.1 Study Target Groups

Drivers in the hand controls group and assorted equipment group were chosen as the target groups for this study in order to ensure the use of adaptive driving aids and/or the structural conversion of a vehicle.

Hand controls, generally required by individuals with restricted use of the lower limbs, are adaptive driving aids which enable a driver to manually operate the accelerator and the brake.

The assorted equipment category pertains to driving aids such as foot controls, brake extensions, steering wheel spinners, left-side gas pedals and right-side directional signals which meet the needs of drivers with varying disabilities.

2.2.2 Pilot Test Target Groups

Although automatic transmission and outside rear view mirrors are considered to be fairly standard equipment, a pilot test was conducted to ascertain whether drivers who require this type of equipment have special driving needs as well. Generally, drivers restricted to driving with automatic transmission have lost full or partial use of the left or right leg. The restriction of driving with outside rear view mirrors aids the driver with limited neck or upper body movement and the driver who is hard of hearing.

2.3 Research Approach

A self-administered mail survey (Appendix C) was selected as an appropriate method of collecting information from a large number of people. A letter accompanied the questionnaire explaining the purpose of the survey and assuring confidentiality of responses. Respondents were provided with a list of instructions and with the opportunity to request a telephone interview if they had problems writing, a French version of the survey if required, and a summary of the results. Only one person requested a telephone interview, four persons requested a French version of the survey and over one-third of the respondents requested a summary of the results. A self-addressed, postage paid, return envelope was also enclosed with the questionnaire.

2.4 Sampling and Sample Size

2.4.1 Study Target Groups

A decision was made to survey the entire population of drivers who require hand controls and the entire population of drivers who require assorted equipment for the following reasons: to provide everyone with the opportunity to respond; to offset the possibility of a low response rate (not unusual for mail surveys); and to obtain as much information as possible.

Questionnaires were sent to the 1,477 persons identified as requiring hand controls and the 64 persons identified as requiring assorted equipment.

2.4.2 Pilot Test Target Groups

Systematic random sampling was used for the selection of respondents within the automatic transmission and outside rear view mirrors categories. The number of responses required to obtain a 95% confidence level with an error range of $\pm$ 5% was determined for both groups. These numbers were inflated to account for the possibility of a response rate as low as 25%, and then 10% of this calculated sample size was used in the pilot test.

In total, 130 drivers requiring automatic transmission and 100 drivers requiring outside rear view mirrors were sent questionnaires.

2.5 Survey Instrument

The questionnaire was pretested with clients of the Hugh MacMillan Medical Centre who had previously or were currently enrolled in the driver education program for disabled drivers.

The questionnaire addressed five general areas: travel and transportation needs; vehicle design, conversions and adaptive driving aids; future vehicular needs; nature and extent of driving disabilities; and demographic and general background information.

The intent of the first section on travel and transportation needs was to obtain a user's assessment of driving-related services (i.e. parking,

licensing procedures, insurance) and information on the driving history of respondents and their travel behaviour.

The next section addressed the design features of the vehicle currently driven, vehicle conversions and adaptive driving aids. Respondents were also asked what preferences they have for a future vehicle. Issues concerning vehicle design, factory options, driving aids, vehicle conversions, potential future options and price were also addressed.

The following section was designed to identify the nature and the severity of the disability as it affects driving functions in order to match functional disabilities with driving-related needs and the potential demand for specific types of driving equipment.

The final section was structured to obtain a description of the group of respondents in terms of age, sex, employment, annual household income, education, geographical distribution and living arrangement.

3. DATA ANALYSIS AND LIMITATIONS

3.1 Response Rate

In total, 1,541 questionnaires were sent to all drivers who require the special equipment of hand controls (1,477) and assorted equipment (64). Two hundred and thirty were sent to a sample of drivers who require automatic transmission (130) and outside rear view mirrors (100). Several questionnaires were returned because of unknown addresses of licencees (149) and deceased licencees (51). In calculating the response rates, these numbers were subtracted from the total number to whom questionnaires were sent.

The data analysis was based on a response rate of 51% for the hand controls group and 46% for the assorted equipment group. The actual response rates were even higher, as additional questionnaires were received subsequent to the data analysis. The respondents appeared to be highly motivated, evidenced not only by the above average response rates but by comments volunteered by over 10% of the respondents, such as: "thank you for the opportunity to give our side of the problem" and "these surveys should be done more regularly."

The response rates are relatively high, especially for a mail survey; however, it is not known whether respondents are representative of all drivers who require hand controls or assorted equipment. While the group of hand controls respondents was virtually identical to the population of hand controls drivers in terms of sex distribution, other characteristics of the population were not available for comparison.

The response rates for the pilot test samples were 26% for the automatic transmission group and 18% for the outside rear view mirrors group. The much lower response rate of the pilot test samples may be partly attributed to the fact that the questionnaire covered a broad range of disabilities and special equipment which many did not find relevant to them. A summary of the results of the pilot study is provided in Appendix B.

3.2 Nature of Questions

The next two chapters of this report provide the detailed results of the hand controls group and the major findings of the assorted equipment group. The results are based on a total of 670 responses from the hand controls group and 26 responses from the assorted equipment group.

Frequency tables for both the hand controls group and the assorted equipment group are presented in Appendix A. It should be noted that the total number of respondents for each question varies due to respondents who did not reply or for whom the question was not applicable.

A variety of question structures were used in the survey. Many of the questions were closed-ended and the results of these are presented in terms of the frequency of responses (both numbers and percentages) to each of the alternatives that were provided. Evaluative comments were elicited by the use of five-point qualitative scales of level of satisfaction and level of interest. The results are presented in terms of the frequency of responses

to each point on the scale including the strength of response (e.g. [dis] satisfied to very [dis]satisfied) and a "no opinion" or in some cases a "not applicable" category.

Open-ended questions were used frequently in this questionnaire in order to obtain as much information as possible, especially in areas that were unfamiliar. For example, respondents were asked to describe problems or provide suggestions with respect to vehicle design, conversions and adaptive driving aids. It should be noted that the response rates for open-ended questions, because they require respondents to generate their own responses, tend to be lower than those for closed-ended questions. Results are presented in terms of the frequency of responses (both number and percentages) to the categories that were developed by grouping the responses.

Due to the large volume of data collected, cross-tabulations were kept to a minimum. They were carried out only for selected questions and were used to provide additional observations which are mentioned in the report. Further cross-tabulations are possible and may be considered at a future date.

The results of the study, based on the experiences and views of drivers who are currently licensed to drive with special equipment, are presented in a descriptive form. The purpose of this survey was to obtain general information and qualitative data from the user's point of view rather than to test hypotheses. Thus, no statistical tests were carried out. In observing the data, in addition to looking at the numbers and proportion providing responses, it is important to consider the overall distribution or pattern of results for a particular question and the strength of those responses (e.g. very satisfied as compared to satisfied).

4. RESULTS FROM THE HAND CONTROLS GROUP

4.1 Profile of Driver

Before the driving-related needs of drivers who require hand controls can be better understood, it is necessary to look at the characteristics of the group itself. The design and development of vehicles, adaptive driving aids and vehicle conversions demand a knowledge of the nature and extent of disabilities which affect the physical ability of these drivers. Efforts at policy and planning also require quantitative information on the demographic and socio-economic characteristics of the driving disabled group.

4.1.1 Nature and Extent of Driving-Related Disabilities (Tables A-1 to A-12)

To provide a profile of drivers in the hand controls group, closed-ended questions were asked about the type of disability experienced; the part of the body affected; the nature, extent and severity of upper/lower body limitations; the use of assistive devices; restrictions in neck movement; and the effect on balance.

Eighteen different disabilities were reported by the respondents in the hand controls group, the three most prevalent being: paraplegia (50%), polio (20%) and quadriplegia (11%). The nature of the disabilities affecting these drivers is such that the majority of respondents (97%) have restricted use of their lower limbs and of these, 60% have absolutely no function of their legs. Thus, many of the respondents (84%) depend on a wheelchair for mobility, 23% require crutches, and 18% require a foot or leg brace.

A further 136 respondents (23%) reported having upper body limitations as well, with functional limitations of both arms (79%), although the vast majority (82%) have partial use of the arms.

Balance was reported to be partly affected by over half of the group (52%) and totally affected by another 12%. Limited neck movement was reported by 5% of the 644 respondents.

4.1.2 Demographic and Socio-Economic Characteristics (Tables A-13 to A-20)

Sex Distribution (Table A-13)

There is a preponderance of males who are licensed to drive with hand controls (74%) compared to females (26%). This difference is large when compared to current licensing statistics for Ontario which show a distribution in the general driving population of 56% males and 44% females. As one means of ensuring that the group of respondents is representative of the hand controls driver population in Ontario, the sex distribution of the two groups was compared. The distribution of respondents by sex in the hand controls group is virtually the same as that for the Ontario population of hand controls drivers.

Age Distribution (Table A-14)

The majority of drivers who require hand controls are between the ages of 25 and 64 years. Compared to the age distribution of the general driving population in Ontario, there is a larger proportion of hand control drivers in the age range of 35 to 64 years and a smaller proportion in the under 25 age group.

Living Arrangement (Table A-15)

Fifty-five percent of respondents report that they live with their spouse/partner, 19% live with relatives, 3% live with their children and 2% live in shared or group accommodation. In other words, the majority of the respondents surveyed (79%) live with others, 77% in a family arrangement. Twenty-one percent of respondents live alone.

Education (Table A-16)

Generally speaking, the hand controls respondents are well-educated. Approximately 46% have some post secondary education and of those, 6% have a post graduate degree. Within the hand controls group, there is a higher proportion who have had some college or university education as compared to the general Ontario population.

Annual Household Income (Table A-17)

Approximately twenty-four percent of respondents have an annual household income under $10,000, 24% between $10,000 and $19,999, 20% between $20,000 and $29,999, 18% over $40,000 and 15% between $30,000 and $39,999. Compared to Statistics Canada census data for 1981, the distribution of income levels of respondents differs from that of the general population in Ontario. While there is a similar proportion of respondents in the income bracket of $10,000 to $19,999, there is a smaller proportion in the middle income bracket of $20,000 to $39,999 and a larger proportion in the under $10,000 and over $40,000 income brackets.

Employment Status (Table A-18)

Almost half the respondents are employed either full-time (40%) or part-time (8%), while another 5% attend school. Of those respondents who reported that they do not work (49%), 15% are currently unemployed, 14% are unable to work, 16% are retired and 4% are homemakers. Of the 313 respondents who are employed, 91% are employed outside the home. More of these respondents are employed as compared to the results of a survey of physically handicapped persons in Ontario in which about 19% of respondents were employed full-time and about 7% part-time (Ontario Ministry of Health, 1982).

Location of Residence (Tables A-19 & A-20)

Sixty-six per cent of drivers in the hand controls group reside in an urban location, 20% live in a rural area and 14% live in the suburbs.

The distribution of respondents by region reflects the pattern of population densities of the five regions of Ontario. Over half the

respondents (52%) live in central Ontario, 22% in western Ontario, 17% in eastern Ontario, 6% in northwestern Ontario and 4% in northeastern Ontario.

4.2 Travel and Transportation Needs

4.2.1 Vehicular Access (Tables A-21 to A-23)

The majority of respondents (96%) have regular access to a vehicle. Of the 27 respondents (4%) who do not have regular access to a vehicle, the most frequent explanation given was lack of affordability (42%), followed by a worsening of disability (21%), the lack of a vehicle (21%), the high cost of insurance (13%) and the inability to enter a vehicle without assistance (4%).

The majority of 668 respondents (84%) own their vehicle while 7% drive a vehicle owned by a family member or friend, 6% share ownership of a vehicle, 2% lease or rent a vehicle and 1% drive a company vehicle. Over half the respondents (58%) share their vehicle with others which suggests that vehicles and driving aids need to be designed to facilitate the use of a vehicle by both disabled and able-bodied drivers.

4.2.2 Modal Choice (Tables A-24A and A-25)

In order to determine the extent to which various transportation modes are used, respondents were provided with a list of five modes of transportation - driver of vehicle, passenger in a private vehicle, special transit, public transportation and taxi - and were asked to indicate the average number of monthly trips they make using each mode. The response categories provided were: 1 to 10 trips, 11 to 20 trips, 21 to 30 trips, over 30 trips and not applicable. Six hundred and five respondents use the self-drive option, 233 travel as vehicle passenger, 91 use special transit, 60 use taxi and 17 use public transit. Special transit and taxis are used by a smaller proportion of rural residents than urban or suburban residents.

The self-drive option is used more frequently than other modes. Forty-seven percent of these drivers make over 30 trips per month, 21% between 21 and 30 trips, whereas the majority of users of other modes report making an average of one to ten trips per month as: passenger of a vehicle (69%); by special transit (69%); by taxi (93%); and by public transit (71%). The frequency of trips made by respondents using the self-drive option is similar across the province and for urban, suburban, or rural areas.

Respondents were provided with a list of possible responses to see whether disabled drivers are forced to drive because they lack alternative transportation or whether they choose to drive. The majority of respondents prefer to drive: 38% indicated that other transportation is available but they prefer to drive, and 31% reported that no other transportation is available but even if it was, they would still prefer to drive. A number (18%) must drive because they lack alternative transportation. Seven percent of respondents are required to drive as part of their job.

Another 6% of respondents generated the following reasons for driving: other transportation not available at night; alternatives inefficient and unreliable; alternatives not convenient; use of other alternatives subject to weather; physical disability prohibits use of other transportation modes; driving requires less effort and time to reach destination; driving for specific purposes such as out-of-town driving, for school, for pleasure only, for shopping/personal needs; more relaxing to drive; and provides a sense of independence.

4.2.3 Driving Exposure (Tables A-26 to A-30)

Eighty-three percent of respondents reported that most of their daily driving is within the city, town or village where they live, whereas 17% reported that most of their daily driving is between cities. A higher proportion of drivers residing in rural areas reported that they drive between cities on a daily basis.

The largest proportion (33%) reported driving between 8,000 and 16,000 kilometers per year. Compared to an estimate of exposure rates for the general driving population in Canada (Stewart, 1981), there is an indication that this group of disabled drivers may drive more kilometers per year than the average Canadian driver.

The majority of drivers (90%), once licensed, had access to a suitably adapted vehicle. Although there was a high variation in responses (S.D. = 11 years), this group of respondents has been licensed to drive with hand controls for an average of 15 years. Over half the respondents (54%) had previously driven a vehicle for an average of 13 years (S.D. = 12 years) before special equipment was required. However, a significant proportion (46%) first learned to drive with special equipment.

4.2.4 Assessment of Driving-Related Services

Using a 5-point scale ranging from very satisfied to very dissatisfied, respondents were asked to indicate their level of satisfaction with a number of driving services.

Parking (Tables A-31 to A-33)

Respondents were asked about their level of satisfaction with the availability of parking spaces designated for handicapped persons, the enforcement of parking provisions for handicapped drivers and the options available for parking a vehicle.

The greatest level of dissatisfaction appears to be with the enforcement of reserved parking provisions. Of 634 respondents, 27% indicated that they are dissatisfied and 54% reported being very dissatisfied.

Approximately 51% of respondents expressed satisfaction with the availability of designated parking spaces for handicapped persons and 48% reported dissatisfaction. This question is difficult to interpret as there was some confusion as to the meaning of the "availability of designated parking spaces". Some interpreted it as meaning the actual number of spaces provided while others linked availability to the enforcement of parking provisions (i.e. whether spaces are occupied when needed).

For example, a few dissatisfied respondents mentioned that there are indeed enough designated parking spaces if able-bodied drivers would refrain from using them.

Approximately 49% expressed dissatisfaction with parking options while 39% expressed satisfaction. This question was intended to get views on the various parking options available, such as underground parking, street parking, etc., but obviously was not detailed enough as indeed a number of respondents (11%) indicated that they did not understand the question and 1% felt that the question was not applicable to them.

Driving Training Program (Tables A-34 to A-35)

Respondents were asked to assess both the availability and quality of special driver training programs for disabled persons. With respect to availabity of driving training programs, the largest proportion of 611 respondents offered no opinion (35%) or responded with "Not Applicable" (20%) suggesting that perhaps these drivers never took a special driver training program. Of the remaining respondents who expressed an opinion, 21% are satisfied and 7% are very satisfied while 11% are dissatisfied and 7% are very dissatisfied.

When asked to assess the quality of special driver training programs, 40% of the respondents offered no opinion and 21% did not find the question to be applicable. These results again suggest that many did not receive special driver training. Of the remaining respondents, 28% expressed satisfaction with the quality of special driver training programs and 11% expressed dissatisfaction.

Professional Assessment of Driving Ability and Needs (Tables A-36 & A-37)

When asked for their level of satisfaction with the availability of professional assessment, many respondents had either no opinion (36%) or felt that the question was not applicable to them (17%). From these responses, one could infer that these drivers have never received a professional assessment of their driving ability or needs. Of those expressing an opinion, 29% are satisfied and 18% are dissatisfied.

Similar results were found with respect to the quality of professional assessment with 35% of 606 respondents expressing no opinion and 18% finding the question to be not applicable. While a larger proportion of respondents (35%) appear to be satisfied with the quality, 12% are dissatisfied.

Licensing Requirements and Procedures (Table A-38)

Licensing requirements and procedures appear to be highly satisfactory to the majority of drivers; 64% indicated that they are satisfied and 17% indicated that they are very satisfied. Of the remaining respondents, 6% are dissatisfied, 5% are very dissatisfied, 8% expressed no opinion and 1% felt that the question was not applicable.

Availability of Vehicle Insurance (Table A-39)

The availability of vehicle insurance is satisfactory to 54% and very satisfactory to 22%. However, of the 20% who expressed dissatisfaction, 10% are very dissatisfied.

Provincial Licence Plates for Disabled Persons (Tables A-40 & A-41)

Provincial licence plates displaying the international symbol of access identify vehicles which are driven by, or carry as passengers, disabled persons. Vehicles bearing these plates can be parked in spaces reserved for disabled persons. These licence plates are issued to any person whose mobility is seriously restricted for medical reasons or who requires the use of a mobility device. They are also available to persons who regularly transport physically disabled persons and are issued without extra charge on request. Only self-certification is required for registration.

When asked whether they are satisfied with these licence plates, 65% indicated they are; however, 23% expressed dissatisfaction, 10% offered no opinion and 3% indicated that they are not eligible. When asked to give their reasons for dissatisfaction, the most frequent were: plates are too easy to obtain (33%); plates label driver as being disabled thus, endangering personal safety (24%); plates imply a disabled driver requires special consideration when driving (16%); other people don't recognize or care (6%); not aware of requirements (4%); not portable (2%); and not available where I live (2%).

Municipal Parking Permits (Tables A-42 & A-43)

The intent of municipal parking permits is to afford a greater degree of mobility to permanently handicapped persons by providing special parking privileges. For example, permits may allow for parking in "no parking" zones for up to 24 hours or at parking meters for up to 24 hours without paying. These permits are portable and are usually displayed in the window of the vehicle to identify that the vehicle is transporting a physically disabled person. Not all municipalities in Ontario provide parking permits.

Forty-eight percent of the respondents expressed satisfaction with special municipal parking permits, while 26% expressed dissatisfaction, 21% had no opinion and 5% claimed they are not eligible for these permits. In response to an open-ended question asking why they are not satisfied, the main reasons given were: not universally recognized by all municipalities (25%); not available in all municipalities (15%); not aware of special parking permits (12%); police still ticket vehicle (10%); too easy to obtain (9%); and restrictions for eligibility (3%). Observation of the data shows a larger proportion of dissatisfied respondents reside in suburban and rural areas than in urban areas.

Further Comments

Respondents were given an opportunity to provide further comments on their driving experiences. Two hundred and eighty responded to the open-ended question, highlighting such issues as parking, driver training programs, insurance practices, licensing requirements and procedures, and the use of

gas stations. The following summarizes many of the comments made but does not include a large number of single responses:

- enforcement of parking provisions is lacking (45%);
- parking spaces are too narrow (14%);
- discriminatory insurance practices are employed (12%);
- too few reserved parking spaces available (10%);
- lack awareness of what driving programs are available (6%);
- poor location of parking spaces such as those next to high curbs (3%);
- licensing requirements are too complicated (3%);
- parking spaces are too far from destination (2%);
- special testing needed more often (1%); and
- self-serve gas stations pose many problems (1%).

4.3 Description of Current Vehicle

4.3.1 Type of Vehicle (Tables A-44 to A-46)

Most of the respondents (79%) in the hand controls group make use of standard production cars. The most common type of vehicle driven is a passenger car (73%), followed by a van (16%), station wagon (6%), truck (3%) and mini van (2%). The most common make of vehicle driven is General Motors (52%), followed by Ford (22%) and Chrysler (19%). Amongst other makes of vehicles reported are Hyundai (2%), Toyota (1%), AMC (1%), and Honda (1%).

The average age of all vehicles driven by this group is 6 years. Approximately an equal number of respondents drive a vehicle which is less than 6 years of age as drive a vehicle which is over 6 years of age. Based on information provided by Statistics Canada (Household Surveys Division, personal communication, September 23, 1986), the average age of vehicles currently being driven by the general driving population is estimated to be 5.8 years for personal-use passenger cars and 6.3 years for personal-use vans and light trucks. These estimates are derived from the Fuel Consumption Survey and are subject to certain limitations. Given that disabled drivers may suffer greater inconveniences should their vehicle break down, it may be noted that about 16% drive vehicles which are ten years or older. The expense of installing adaptive driving aids or of converting the vehicle both in terms of time and money may be a consideration for keeping a vehicle.

4.3.2 Access to Vehicle (Tables A-47 to A-49)

Approximately 64% of 506 respondents who drive a car reported driving a two-door model as opposed to a four-door model (36%) while 80% of the 130 respondents who drive a van have sliding side doors as opposed to swing doors (20%) in their vehicle.

Over half of all the vehicles driven have a bench (27%) or split bench front seat (27%) while a number of vehicles (42%) have bucket seats. Only 5% of the 541 wheelchair users drive from a wheelchair.

4.3.3 Factory Options (Table A-50)

Vehicles driven by the hand controls group are equipped, on average, with seven factory options. The standard deviation for this average is 3. The seven most widely used options are:

automatic transmission (99%); power steering (96%); power brakes (95%); adjustable seats (73%); rear defroster (73%); remote, adjustable left outside mirror (56%); and air conditioning (40%).

4.3.4 Cost of Vehicle (Tables A-51 to A-54)

The reported prices paid for a vehicle ranged from as low as $100 to as high as $36,000. When the data were grouped, the largest proportion of vehicles (33%) cost between $5,000 and $9,999 followed by 28% between $10,000 and $14,999, 20% under $5,000, 14% between $15,000 and $19,000, and 4% $20,000 or more.

When asked if they had received any mobility allowance or financial assistance to purchase and/or convert their vehicle, the majority (75%) checked no, 23% yes and 2% not applicable. A list of four main sources was provided - government agency, private insurance, private sources (i.e. family trust fund) and other (i.e. service clubs, community service organizations). Of the 23% who did receive some financial assistance, 69% received assistance from a government agency; 16% from a service club or a community service organization; 14% from private insurance; and 10% from private sources. Under government agency, some respondents noted Department of Veteran Affairs, Worker's Compensation Board and the Ontario provincial sales tax rebate. It may be possible that not all respondents reported the Ontario provincial sales tax rebate, which allows a permanently disabled individual to claim a refund of 7% for the tax paid on a vehicle, as financial assistance from a government agency.

Respondents were asked how much it cost them to purchase vehicle insurance in 1985. The average price reported by these drivers for vehicle insurance in 1985 was $579 with a variation as indicated by the standard deviation of $422. Reported rates ranged from $170 to $4,400. It should be noted that this average includes reduced rates paid by drivers who use their vehicle for only part of the year. Thus, the average may include six-month rates due to the fact that rates were only adjusted when respondents indicated that they were reporting for a six month period.

A number of respondents (8%) paid over $1,000 for their 1985 vehicle insurance. Two-thirds of these drivers were between 16 and 34 years of age. Based on insurance figures, the average 1985 insurance rate paid by the general driving population in Ontario is estimated to be approximately $461.

4.3.5 Assessment of Vehicle Design (Tables A-55 & A-56)

Fifteen percent of 631 respondents said yes to a question which asked if their vehicle has design features which fail to meet their needs or enable them to drive safely. When asked in an open-ended question to describe these features, the following were noted:

- not enough room behind driver's seat often resulting in torn upholstery from putting a wheelchair into the back seat (16%);
- foot-operated controls such as for the dimmer switch (11%);
- poor location of secondary controls such as windshield wipers, headlights, etc. (11%);

- access problems due to centre console, gear shifts and humps (5%);
- difficulty moving seats because tracks are too short (5%); and
- lack of leg room (3%); and
- poor wheelchair lock system (2%).

Other individual comments included: vehicle doesn't meet requirement for lift; vehicle too high off ground; larger windows needed; trunk too small; seat belts are strangling and difficult to locate and secure; seats are too low; vinyl seat covers are required for sliding across the seat and under steering wheel; bucket seats needed for support; and steering column too short.

4.4 Vehicle Conversions

For the purposes of this study, vehicle conversions refer to any structural modifications of a vehicle required for the installation of a power pan, wheelchair channels, raised roof, dropped floor or raised side door. Respondents were provided with a list of these conversions and were asked to put a check beside those which had been made to their vehicle and those with which they had problems. Respondents were then asked to describe these problems.

4.4.1 Nature of Vehicle Conversions (Tables A-57 to A-61, A-69)

A total of 55 respondents (9%) reported that their vehicles had been structurally converted in one or more of the following ways: raised roof (66%), power pan (15%), wheel channels (15%), raised side door (11%), and dropped floor (4%). A few reported minor structural conversions such as changes to the dashboard, the installation of a window in the sliding side door and rebuilt driver's seats. One respondent removed the centre console because it made entry into the vehicle difficult.

Of the vehicles which were converted, the largest proportion were Ford vans (35%) followed by GMC vans (25%), Chevrolet vans (15%), passenger cars (16%), Dodge vans (7%) and station wagons (2%).

Ninety-three percent of vehicles were converted in Ontario, while 8% were converted in the United States. Over one-third (35%) of the vehicles converted in Ontario were modified in Toronto. Vehicles were converted by companies specializing in vehicle conversions (76%), dealerships (15%), licensed auto mechanics (8%), personal contacts (6%) and others (8%).

Many of the vehicles (79%) were new when they were converted, 13% were between one and three years of age, 6% were four to five years old and 2% were over five years old.

4.4.2 Cost of Vehicle Conversion (Table A-62)

The average price paid to have a vehicle structurally converted was approximately $7,000 (S.D. = $5,323) with reported prices ranging from $300 for a seat conversion to $25,000 for a power pan and raised roof. The average price paid by respondents for a vehicle which has been converted and is equipped with adaptive driving aids was $21,123 (S.D. = $14,076), reported prices ranging from $8,800 to $40,000.

While the average 1985 vehicle insurance rate was approximately $579 for the hand controls group as a whole, the average price paid for insurance by persons driving a structurally converted vehicle was $903 (S.D. = $658).

When asked if they had received any mobility allowance or financial assistance to purchase and/or convert their vehicle, approximately 50% of the 55 drivers who had their vehicles structurally converted said yes. Given a list of four main sources - government agency, private insurance, private sources and other organizations such as service clubs or community service organizations - the majority (78%) indicated that they received assistance from a government source. A few respondents mentioned under government agency the Worker's Compensation Board, Department of Veteran Affairs and the provincial sales tax rebate on vehicles. Approximately 15% received some assistance from organizations such as service clubs or community organizations and 7% received aid from private sources such as the family. One respondent received money from a private insurance plan.

4.4.3 Reported Problems (Table A-63)

Of the 8 respondents whose vehicles have power pans, two reported electrical problems and one respondent noted that not only was the power pan not absolutely level with the floor but the activating rod had been bent twice.

Five of the 36 respondents who have a raised roof reported problems: four with respect to leakage and one with an inability to park indoors (1).

Two of the six respondents who have raised the side doors of their vehicle reported problems such as the doors not shutting properly and the poor adjustment of the door causing leakage.

Three of eight respondents who had wheel channels put in their vehicle made the following comments: due to the width of the wheelchair there were problems with setting channels properly; difficulties arose in obtaining proper height for driving vision while accommodating wheelchair footrests; and wheel channels were too narrow to allow front wheelchair wheels to rotate in their casters when backing out of the channels, thus causing them to jam.

4.4.4 Assessment of Vehicle Conversion (Tables A-64 to A-71)

Respondents were asked to rate a number of aspects dealing with structural conversions on a scale ranging from very satisfied to very dissatisfied, including a no opinion point. With respect to their perception of the safety of the vehicle conversion, 52% of respondents reported that they are satisfied and 40% very satisfied. Six percent reported that they were dissatisfied.

Although most respondents reported that they are satisfied (46%) or very satisfied (27%) with the service and maintenance of vehicle and parts, 14% indicated that they are dissatisfied and 10% are very dissatisfied.

The quality of work involved in the structural conversion was perceived to be highly satisfactory by respondents; 47% are satisfied and 31% are very satisfied. However, 14% are dissatisfied and 6% are very dissatisfied.

The availability of contractors for vehicle conversions would appear to be somewhat limited. Thirty-three percent of respondents indicated that they are dissatisfied and 28% are very dissatisfied with the availability of contractors. On the other hand, 22% reported that they are satisfied and 6% are very satisfied.

The time required to arrange for the vehicle conversion was reported to be satisfactory by 48% and very satisfactory by 6%. However, 26% are dissatisfied and 14% are very dissatisfied. With respect to the time required to complete the structural conversion, 45% are satisfied, 6% are very satisfied, 29% are dissatisfied and 12% are very dissatisfied.

There is apparently a lack of information on structural conversions as the majority of respondents expressed dissatisfaction; 35% are dissatisfied and 25% are very dissatisfied. Of those who expressed satisfaction, 25% are satisfied and 6% are very satisfied.

Over half of the respondents (59%) expressed dissatisfaction with the cost of vehicle conversions; 20% are dissatisfied and another 39% are very dissatisfied. Twenty-two percent are satisfied and 7% are very satisfied.

4.4.5 Suggestions for Improvement

Ten people provided the following suggestions in response to an open-ended question asking how vehicle conversions can be changed or improved: higher roofs in mini vans (9); lower drive shafts to create lower floors (5); flat floors (2); stabilizer bar in front suspension (1); disability package for vans at a discount (1); and extra leaf springs on the side of the van where the lift is located to prevent sagging (1).

4.5 Adaptive Driving Aids

An effort was made to identify the driving aids currently used, the number of drivers using these aids, the problems associated with this equipment and a user's assessment of a number of features related to adaptive driving aids. Adaptive driving aids, for the purposes of this study, were grouped according to their function as follows: acceleration/braking aids, steering aids, vision aids, control lever aids, safety aids and entry/exit aids. Respondents were provided with a complete list of driving aids under each of these categories and asked to put a check beside those which they use and those with which they have problems. They were then asked in an open-ended question to describe these problems.

4.5.1 Usage of Adaptive Driving Aids (Tables A-72 to A-78)

Acceleration/braking aids are the most widely used, as reported by 608 respondents. Ranked in terms of number of users, the next most frequently used types of aids are vision aids (344), safety aids (234), steering aids (205), control lever aids (200), and entry/exit aids (166).

Acceleration/Braking Aids

Acceleration/braking aids are generally required by drivers who have restricted use of both legs. These aids enable the driver to perform many driving tasks manually. Of the 608 respondents who reported using acceleration/braking aids, most (97%) use hand controls for manual acceleration and braking. Other aids mentioned include: parking brake extension lever (13%); reduced effort acceleration/braking (7%); electric parking brakes (2%); gear selector on floor (1%); hand clutch control (1%); and left-hand gear selector (1%).

Vision Aids

Over half of the drivers who have regular access to a vehicle reported the use of vision aids. These aids are required when a driver has limited neck or upper body movement. Of the 344 respondents who use vision aids, the most widely used is that of the left side-mounted convex rear view mirror (65%), followed by: right side-mounted convex rear view mirror (56%); full range rear view mirror (45%); and dual mirrors (35%).

Safety Aids

Two hundred and thirty-four respondents use one or more of the following safety aids: safety torso restraint or chest harness for those who have poor balance (60%); two-way radio (50%); fire extinguisher (19%); power/manual wheelchair restraints (9%); and car telephone (5%).

Steering Aids

Two hundred and five drivers reported that they use steering aids which assist persons with limited upper body movement. The steering aid most widely used is the steering spinner (85%), a device which enables a person with one arm to drive. It is also helpful for drivers with a weak grip. Other steering aids reported to be used are: reduced effort steering (19%); steering column extension (8%); modified steering wheel (8%); steering column adjuster (6%); emergency steering backup (4%); and horizontal steering (1%).

Control Lever Aids

Difficulties are often encountered reaching for and/or manipulating secondary controls such as wipers, headlights, dimmer switch and turn signal. Of the 200 respondents who use control lever aids, the most common is the remote dimmer switch (72%), followed by: remote secondary controls for wipers, horn, etc. (48%); right side turn signal (10%); centre or door console (9%); gear selector extension lever (4%); keyless ignition (3%); dashboard extensions/rings (3%); powered gear selector (2%); and remote starter (2%).

Entry/Exit Aids

Various aids to assist in entering or exiting a vehicle were reported by 166 respondents, including: automatic lift (62%); automatic swing or sliding doors (52%); transfer aids such as a sliding board (28%); track seating (21%); remote control door/lift (19%); removable insert boards to assist in stowing the wheelchair behind the driver's seat (8%); and removable seat base (7%).

4.5.2 Reported Problems (Tables A-73 to A-78, A-110)

Problems reported with adaptive drivings aids were grouped in one of the following categories: equipment failures; operational difficulties; equipment interference with the body; equipment interference with the use of secondary controls; lack of qualified installers and maintenance/repair services; and poor material construction. Of the 287 problems reported, most (46%) were equipment failures such as part breakage, mounting failures, and electrical problems. Other problems relate to operational difficulties (19%), equipment interference with the body (15%), lack of qualified installers and maintenance/repair services (14%), equipment interference with the use of secondary controls (5%) and poor material construction (2%). A description of all the specific problems that were reported with driving aids is provided in Table A-110.

The following sections describe the nature of the problems associated with hand controls, automatic lifts, steering spinners, automatic doors, safety torso restraints/chest harnesses and right side-mounted convex rear view mirrors. These were the driving aids for which most problems were reported.

Hand Controls

Sixty-eight (12%) of the 608 users of hand controls reported problems with their equipment. Thirty-two noted equipment failures such as: broken cotter pin which resulted in the total loss of acceleration; snapped or broken cables; broken main bolts; and too much slack in controls requiring considerable movement on the driver's part which is dangerous for those with poor balance. One respondent noted that the accelerator stuck causing him to roll the vehicle into the ditch.

Twelve respondents reported that they bang their knees while driving or while entering/exiting the vehicle because hand controls are bulky and usually extend below the steering column.

Equipment interference was noted by 10 users who reported that hand controls interfere with the operation of secondary controls such as windshield wipers, headlights and cruise control.

Operational difficulties were noted by 11 respondents and include problems related to being able to brake and accelerate simultaneously and the fact that secondary controls are difficult to use because one hand is on the steering wheel and the other is occupied with the hand controls.

Eleven respondents reported the lack of qualified installers and maintenance/service to be a problem with hand controls. At the end of the questionnaire, 3 respondents provided unsolicited comments concerning the need for the inspection and approval of hand controls and their installation.

Automatic Lift

Thirty (29%) of the 103 users reported problems with their automatic lifts. Equipment failures were noted by 14 respondents and included broken cables, broken chains, electrical problems and freezing of the lift in the winter. One respondent commented that the lift had actually dropped to ground level twice with a person aboard. The persistent problem of lack of qualified installers and maintenance/repair service was again noted by 5 respondents.

Steering Spinner

Twenty-three (13%) of the 175 drivers who require steering spinners reported problems. Twelve respondents reported equipment failures, such as the steering spinner falling off during turns. Others who share their vehicle with able-bodied drivers reported that the constant removal and reapplication has actually altered the shape of the steering wheel. Comments from a few respondents indicate that plastic steering columns are not substantial enough for either hand controls or steering spinners.

Three users reported that the steering spinner has a tendency to catch on clothing. In terms of interference with secondary controls, one respondent reported that the knob on the bottom of the palm grip can lock steering wheel against hand controls.

Five respondents reported operational difficulties such as the steering spinner being difficult to grip and the difficulty of removing and reapplying the steering spinner.

Automatic Doors

Twenty-two (26%) of the 86 users of automatic doors reported problems. Most (12) experienced equipment failures with automatic doors such as broken chains, broken L-bars for holding sliding doors straight, faulty wiring and freezing in the winter. The problem of lack of qualified maintenance/repair services was noted by 5 respondents as was the need for frequent service (2).

Safety Torso Restraint/Chest Harness

Twenty-one (15%) of the 140 drivers who reported using a safety torso restraint or chest harness have experienced problems. A number of respondents claimed that this safety aid is too restrictive (17) and, as such, can pose a driving hazard (2).

Right Side-Mounted Convex Rear View Mirror

Fourteen (7%) of the 193 drivers who use a right side-mounted convex rear view mirror have experienced problems associated with: difficulties in reaching or adjusting the passenger side mirror while driving (6), difficulty in judging distance (7), freezing of the mirror in winter and the need for longer mirrors (1).

4.5.3 Price of Adaptive Driving Aids (Table A-79)

The average price paid by drivers in the hand controls group for adaptive driving aids was approximately $985 (S.D. = $1,911). There was a wide variation in the prices reported, from $5 to $20,000. The largest percentage of respondents (46%) paid between $251 and $500 followed by 36% who paid between $5 and $250.

4.5.4 Purchase and Installation of Adaptive Driving Aids (Tables A-80 to A-83)

Seventy-six percent of respondents purchased their aids in Ontario while 13% purchased aids from other provinces such as British Columbia (10%), and 12% from the United States. The largest proportion (39%) purchased their aids in Toronto. It may be noted that thirty-five respondents conveyed that their adaptive driving aids are homemade, customized fabrications.

Approximately 37% of the respondents had their adaptive driving aids installed by the vendor, 31% chose a mechanic, 20% used a personal contact, 8% selected the equipment manufacturer and 10% installed the driving aids themselves.

The majority of respondents (79%) feel that the driving aids they currently use could be readily disassembled and reused if they were to purchase another vehicle, 12% do not feel they could be reused and 9% do not know.

4.5.5 Assessment of Adaptive Driving Aids (Tables A-84 to A-92)

Respondents were asked to use a scale ranging from very satisfied to very dissatisfied, including a no opinion point, to assess several aspects related to adaptive driving aids.

When asked about their perception of the safety of adaptive driving aids, 43% of the respondents reported being satisfied, and 51% are very satisfied.

Although thirty-eight percent of respondents are satisfied and 37% are very satisfied with the service and maintenance of equipment, 11% are dissatisfied and 3% are very dissatisfied. A larger proportion of rural residents as compared to suburban and urban residents indicated dissatisfaction.

The quality of installation was viewed to be very satisfactory by 48% and satisfactory by 43%. Five percent indicated that they are dissatisfied and 2% indicated that they are very dissatisfied.

Respondents expressed dissatisfaction with the number of qualified installers available; 27% are dissatisfied and 20% are very dissatisfied. The proportion of respondents expressing dissatisfaction does not appear to differ across the province or by type of location.

The time required to arrange for the installation is satisfactory to more respondents than unsatisfactory; 46% are satisfied and 21% are very satisfied. However, a number are dissatisfied (11%) or very dissatisfied (8%).

More respondents expressed satisfaction than dissatisfaction with the time taken to install adaptive driving aids; 50% are satisfied and 24% are very satisfied. Approximately 10%, however, are dissatisfied and a further 6% are very dissatisfied.

Twenty-seven percent of respondents are dissatisfied and 23% are very dissatisfied with the availability of information on adaptive driving aids. Respondents were provided with a list of possible sources of information and were asked to indicate where they had obtained information on the available conversions or adaptive driving aids best suited to their driving needs. Forty percent indicated that they obtained information from personal contacts such as friends, 31% from professionals, 22% from special organizations, 17% from manufacturers or dealers, 16% from magazine articles and brochures, and 2% from exhibitions.

Twenty-one percent of respondents reported that they are dissatisfied with the price of driving aids and another 28% are very dissatisfied. A number of respondents, however, are satisfied (32%) or very satisfied (10%) with the price.

4.5.6 Suggestions for Improvement

When asked in an open-ended question for suggestions on how driving aids can be improved, 118 (18%) of the 670 hand controls drivers provided comments such as the following:

- reduce prices (36%);
- hand controls should be more compact and more secure (28%);
- more information is needed about adaptive driving aids (21%);
- hand controls should be a factory option (20%);
- secondary controls, such as dimmer switch and wipers, should be located on a secondary control stalk on the steering column (8%);
- hand controls should be portable (7%);
- inspection and approval of the installation process and the driving aids themselves is needed (3%); and
- specialized garages should be available for servicing and repairing adaptive driving aids (3%).

Individual comments were also noted as follows: standardize hand controls and steering spinners so that they can be adapted to any make of vehicle; driving aids should be available at auto stores instead of importing from the U.S.A.; stricter standards for quality control of construction and installation of lifts are required; standards for wheelchair restraints

are required; stronger motor and chain should be used for automatic doors; a device is needed to load and unload folded wheelchair; a better harness system should be developed; seats should be able to be raised and lowered to a greater extent; a left-foot gas pedal that doesn't need to be bolted to the floor and has more direct throttle linkage should be developed; and secondary controls should be electric.

4.6 Future Vehicular Needs

4.6.1 Preferences for Future Vehicle (Tables A-93 to A-97)

Respondents were provided with a number of vehicle design features and options and were asked to indicate the vehicle they would prefer if they were in the market to buy. With respect to size of car, six categories were provided. Many reported a preference for larger size vehicles; 31% indicated a preference for an intermediate size car, 20% a large size car, 20% a regular van and 13% a mini van, while 11% reported a preference for a compact car and 3% a subcompact car.

When asked to choose between a two-door and a four-door model car, 65% indicated a preference for a two-door car and 35% a four-door car. Of the 238 individuals who would prefer to buy a van, when asked to choose between sliding and swing doors, 79% expressed a preference for sliding side doors and 21% for swing doors.

With respect to the four types of driver's seats provided, almost half the respondents (49%) indicated a preference for bucket seats while 24% prefer split bench seats and 17% prefer bench seats. Some expressed an interest in a swivel seat to aid entry and exit (4%). Approximately 12% of the 541 wheelchair users indicated a preference to drive from a wheelchair. As noted earlier, only 5% of wheelchair users currently drive from a wheelchair.

When asked in an open-ended question what factory options would be preferred, those most frequently noted were: power steering (73%), power brakes (70%), automatic transmission (47%), cruise control (42%), power windows (40%), and air conditioning (39%). Factory options suggested by some respondents include: intermittent wipers; rear window washer and wipers; and side window defroster for vans.

The adaptive driving aids reported as being preferred for a future vehicle by 428 respondents in response to an open-ended question are: hand controls (93%), automatic lift (16%), steering spinner (10%), secondary controls, stock-mounted (4%), electric emergency brake (4%), and remote dimmer switch (4%).

In responding to an open-ended question asking what vehicle conversions are preferred in a future vehicle, 47 respondents mentioned the following: automatic lift (51%), raised roof (45%), power pan (15%), wheelchair restraints (9%), dropped floor (4%), raised side doors (4%), raised seat (2%), wheel channels (2%) and powered seat track (2%).

4.6.2 Vehicle Design Considerations (Table A-98)

Respondents were provided with a list of 8 vehicle design features and were asked to indicate which would be the three most important to consider when choosing another vehicle. A number of respondents did not rank order their choices or checked off more than three and as such the results are presented in terms of the the number who selected a particular feature: ease of entry and exit (73%); size of vehicle (42%); head and leg room (36%); wide doors (32%); seats (32%); appearance (30%); accessible storage space (22%); and height of vehicle (15%). Other comments (9%) pertained to fuel economy, reliability, price, capacity to fit hand controls, and ease of handling vehicle.

The following improvements for the design of future vehicles were offered by 158 respondents in response to an open-ended question: increased room in the rear seat to accommodate the storage of a wheelchair (23%), wider doors (20%), elimination of centre consoles (17%), factory installed swivel seats (15%), and increased head and leg room (13%). In terms of factory options, recommendations were made for intermittent wipers (8%) and rear window washer and wipers (8%).

4.6.3 Price Considerations (Tables A-99 to A-102)

An effort was made to determine the price drivers would be willing to pay for the vehicle they had described as being their preference if they were in the market to buy. Using the six categories provided, the largest proportion of the 635 respondents (44%) reported that they would be willing to pay between $10,000 and $14,999 for their next vehicle. Twenty-three percent indicated that they would be willing to pay under $10,000, 22% between $15,000 and $19,999, 7% between $20,000 and $24,999, 3% between $25,000 and $29,999 and 2% $30,000 or more.

As noted earlier, 12% of the 541 wheelchair users when provided with a list of possible driver's seats (i.e. bench, bucket, wheelchair) expressed a preference for driving from a wheelchair. When asked if they would be willing to pay an additional amount to have a <u>car</u> which could be driven from a wheelchair to which level access would be possible without the use of a lift, 34% of 464 respondents indicated that they would. Forty-six percent indicated that they would not be willing to pay an additional amount and 20% do not know.

Wheelchair users were then asked if they would be willing to pay an additional amount for a <u>van</u> which could be driven from a wheelchair and to which level access would be possible without the use of a lift or the need to raise the roof. Slightly more respondents expressed an interest in this option: 41% of 439 respondents would pay an additional amount while 41% would not and 18% do not know.

Given a number of catagories, 25% of respondents reported that they would be in the market to buy a vehicle within two years, 23% within three years, 19% within one year, 19% within four to five years and 14% in over five years.

4.6.4 Potential Self-Drive Options (Tables A-103 to A-106)

Respondents were asked to indicate how interested they might be, using a five-point qualitative scale, in the following options assuming that they were in the market to choose another vehicle, the options were available, and the costs were reasonable to them:

> Option 1 -- A vehicle that would meet their driving needs and would not be identified as a vehicle for disabled drivers.
>
> Option 2 -- A standard production vehicle which could be produced in the future, such as an electric car, for local urban use only.
>
> Option 3 -- Shared ownership of a vehicle adapted to meet their driving needs.
>
> Option 4 -- The rental or leasing of a vehicle adapted to meet their driving needs.

Using an open-ended question, respondents were asked for any comments on the above options.

Respondents expressed a very strong interest in owning a vehicle that would meet their driving needs but would not be recognized as a vehicle for disabled drivers. Twenty-eight percent are interested and 43% are very interested. Reasons for interest include the importance of not being able to label a driver as disabled for personal safety reasons and the implicit assumption that hand controls would be factory installed. A number, however, are not very interested (14%) or not at all interested (10%), some citing the following reasons: identification of a vehicle as belonging to a disabled person is very important for parking purposes and in emergency situations.

The option of a standard production vehicle, such as an electric car for local urban use only, is not of interest to about 61% of respondents. Twenty-seven percent of respondents indicated that they are not very interested and 34% are not at all interested. Reasons given for lack of interest included: the need to purchase a second vehicle for highway use, the restricted use of the vehicle for urban versus rural areas, and the difficulty of having to charge the vehicle at various points. Although the largest proportion of respondents appeared uninterested, 23% are interested, 10% are very interested and 6% have no opinion. The largest proportion of respondents who expressed interest are urban dwellers.

Little interest was expressed in the shared ownership of a vehicle. Twelve percent are not very interested and 66% are not at all interested due to the difficulties associated with sharing a vehicle such as different driving habits and schedules. On the other hand, 10% are interested and 6% are very interested. The proportion of interested respondents is larger for those living in shared or group accommodation, for those having an annual household income of less than $10,000 and for those unable to work or currently unemployed.

The option of renting or leasing a vehicle adapted to meet their driving needs is of interest to 43% of 586 respondents. Twenty-four percent are interested and 19% are very interested. Comments in favour of this option included: important as an emergency vehicle when car is being serviced or repaired; beneficial for travel and vacation purposes; and more affordable than owning a vehicle. The proportion of interested respondents is larger for those residing in urban areas and for those between 25 and 34 years of age. On the other hand, 13% are not very interested and 38% are not at all interested some citing cost as the limiting factor. One respondent expressed dissatisfaction with the hand controls provided in rental vehicles.

4.6.5 Matching of Equipment Used With Equipment Generally Recommended (Tables A-107, A-108, A-109)

Respondents were asked to indicate whether they lack any special equipment that could help them with driving because the cost is too high. Eighty-three percent of 622 respondents do not feel that they are lacking equipment, however, 18% do. When asked in an open-ended question to describe the equipment they lack, the following equipment was noted: factory options (30%) (e.g. power seats, power windows, cruise control); wheelchair lift (15%); mobile telephone (8%); rooftop wheelchair loader (7%); hand controls (6%); remote starter (4%); steering spinner (3%); and zero effort brakes and acceleration (2%).

For selected disabilities, an analysis was carried out to match the type of equipment currently used by respondents with the general equipment recommendations noted in other studies, in particular that of James F. Hickling Management Consultants (1985). This was done to provide a rough indication of the extent of possible unmet equipment needs. Six specific functional disabilities were selected in order to do this analysis, as follows: left leg missing or non-functional; both legs missing or non-functional; short legs; small body size; low level quadriplegia; and high level quadriplegia.

The equipment recommended for each of the above types of disability is listed in Table A-109. Based on the 353 cases examined, there seems to be a number of respondents who do not currently use driving equipment that experts recommend in general, for their particular types of disability, as follows: transfer aids (71%); hand dimmer switch (68%); parking brake extension (63%); spinner knob (59%); six-way power seat (50%); hand controls (19%); power steering (6%); power brakes (5%); and automatic transmission (4%).

This analysis, while limited, suggests that additional driving equipment may be needed by or may benefit those who are currently using special equipment. As noted earlier, many of the respondents probably did not have special driver training or a professional assessment of their driving needs.

5. RESULTS OF THE ASSORTED EQUIPMENT GROUP

Responses to the survey were received from 26 respondents who require assorted equipment, a limited number due to the small population of drivers with this licence restriction. Thus, the results are presented in descriptive terms only. Frequency tables are presented in Appendix A together with the hand controls group.

The results indicate that the travel and transportation needs of those respondents in the assorted equipment group and those in the hand controls group are similar and that their assessment of driving-related needs is also very similar. Differences were apparent in the selection of a vehicle and associated design features, and in the range of adaptive driving aids used. This is likely attributable to differences in the nature and extent of the disabilities affecting these drivers. The following summary presents only those results that are distinctive to the assorted equipment group.

5.1 Nature and Extent of Disabilities (Tables A-1 to A-12)

In general, the mobility of drivers requiring assorted equipment is less restricted than that of drivers requiring hand controls. For example, none of the respondents in the assorted equipment group reported that they use wheelchairs.

Twenty-six respondents reported having one or more of the following disabilities: shortness of body or limbs (8); amputation (8); back/spine impairment (5); stroke (4); hemiplegia (3); paraplegia (3); spina bifida (3); arthritis (2); polio (2); heart condition (1); muscular dystrophy (1); cerebral palsy (1); and head injury (1).

Fifteen of the 20 respondents who reported lower body limitations noted that only one leg is affected. In terms of the severity of the limitation, 13 reported that the leg is affected from the hip down and 3 from the knee and below. Eleven respondents reported partial function of the lower limb(s) affected and 5 reported no function. Assistive devices used by respondents, include: canes (6); leg or foot brace (6); leg or foot prosthesis (5); crutches (2); and special shoes (1).

Fourteen respondents indicated that they have upper body limitations affecting one arm (8) or both arms (6) due to paralysis (6), amputation (4), difficulty moving (3), short limbs (1), spasticity (1), and muscle weakness (1). For most (11) the entire arm is affected from the shoulder down. Seven indicated that they have partial functioning of the arm(s) and 5 reported having no function. Of those respondents with upper body limitations, 5 use the assistive device of an arm or hand prosthesis.

5.2 Current Vehicle Choice (Tables A-44 to A-54)

The mobility aids used by these respondents are lighter and less bulky than a wheelchair and can be stowed or retrieved from a vehicle with little or no problem.

Most of these respondents drive a passenger car (22) while others drive station wagons (2), regular van (1), and truck (1). Unlike the hand controls group, most drive a four-door model (17) rather than a two-door model car (7) and many are equipped with bucket seats (14).

The average price paid for a vehicle was approximately $9,000 (S.D. = $3672) with prices ranging from $3,000 to $18,000. Respondents requiring hand controls, on average, paid more for their vehicles, $9,785, with prices ranging as high as $36,000.

The vehicle features noted in response to an open-ended question as failing to meet their needs or ability to drive safely include: poor location of secondary controls (6); seat tracks which are too short (1); lack of rear window washer and wiper (1); lack of automatic transmission (1); seat belts which are too restrictive (1); inability to use seat belt due to raised seat (1); and improper visibility due to low seats (1).

5.3 Vehicle Conversions

None of the vehicles driven by respondents who use assorted equipment have been structurally converted.

5.4 Adaptive Driving Aids (Tables A-72 to A-92)

These drivers reported using acceleration/braking aids (18), steering aids (13), vision aids (7), safety aids (6), control lever aids (5) and entry/exit aids (3). The range of equipment used is not as extensive as that for drivers requiring hand controls. However, common driving aids are used by drivers in both groups and similar problems are experienced with them.

5.4.1 Usage and Reported Problems

Acceleration/Braking Aids

Of the 18 respondents who reported using acceleration/braking aids, 12 use a left-foot gas pedal, 6 use pedal extensions, 2 use reduced effort braking/acceleration and 1 uses hand controls.

Problems were reported by 4 of the 12 drivers who use a left-foot gas pedal. The specific problem noted was that of the pedal sticking in the winter due to the freezing of melted snow in the hinge. Another respondent reported that the pedal extension requires too much pressure to operate.

Steering Aids

Thirteen respondents reported using one or more of the following steering aids: spinner knob (10), reduced effort steering (2), steering column adjuster (1) and modified steering wheel (1).

Problems were noted by 3 of the 10 drivers who use a spinner device and included: bar on which spinner is attached sometimes catches on clothing because it extends slightly beyond the rim of the steering wheel; hook steering device is too large, preventing quick access to horn; hook on

prosthesis can lock steering spinner preventing the steering wheel from turning; and hook steering spinner obstructs view of dashboard instruments.

Vision Aids

Seven respondents reported using the following vision aids: right side-mounted convex rear view mirror (4), left side-mounted convex rear view mirror (3), full range rear view mirror (3) and dual mirrors (3). No problems were reported with vision aids.

Safety Aids

Only 5 respondents reported using safety aids such as torso restraints/chest harness (4) and a two-way radio (2). The following problems were noted: difficult to engage the regular seat belt, seat belts are restrictive, and unable to use regular seat belts due to a raised driver's seat.

Control Lever Aids

Of the 5 respondents who reported using control lever aids, 2 use the right-side turn signal, 2 use remote secondary controls and 1 uses a remote dimmer switch. One respondent reported that the right side turn signal cannot be welded to the existing aluminum arm.

Entry/Exit Aids

Only 3 respondents in the special equipment group reported using one or more of the following entry/exit aids: automatic doors (1), removable seat base (1), removable floor insert boards (1) and a built-up seat (1). No problems were reported with respect to entry/exit aids.

5.4.2 Price Paid for Adaptive Driving Aids

The average price paid by drivers in the special equipment group for adaptive driving aids was approximately $105, although there was a wide variation (S.D. = $111) with reported prices ranging from $15 to $500. The average price paid by drivers who require hand controls was approximately $985.

5.5 Vehicle Design Considerations (Table A-98)

From a list of 8 vehicle design features, 25 respondents chose the following as being most important: size of vehicle (15); ease of entry and exit (14); seats (11); head and leg room (9); appearance of vehicle (7); accessible storage space (4); wide doors (3); and height of vehicle (3).

Twelve respondents suggested the following improvements for the design of future vehicles:

- seats should be orthopedically designed like those in Japanese and German vehicles (1);
- the dashboard should be lowered for better viewing (1);
- mirrors should be provided on both the left and right front doors of all vehicles (1);

- cars should not be downsized as smaller cars are harder to get crutches into (1);
- more space is needed on the left side of the brake pedal on front wheel drive vehicles and smaller cars (1);
- steering column should be accessible and solid (1);
- dimmer switch should be located on the floor (1);
- better heat supply needed for passengers in rear seat (1);
- more elbow and head room is needed in the driver's compartment (1);
- secondary controls should be more accessible (1);
- seat belts should be less restrictive; and
- gas cap should be easily accessible (1).

6. DISCUSSION

Due to the scarcity of information on the self-drive option, this survey was designed to obtain a broad perspective on the driving-related needs of physically disabled drivers. The questionnaire sought to obtain general information on demographic, lifestyle and travel patterns, and specific information on physical disabilities and vehicle design, conversions and driving aids. The survey also explored level of satisfaction with various aspects related to driving and likely interest in a number of options, including future developments.

In general, the results indicate that the self-drive option is an important consideration to the drivers who are currently licensed to drive with hand controls and assorted equipment. The mobility needs of these drivers are similar in some respects to the needs of the general driving population such as the strong preference for this option and the frequency of travel.

On the other hand these drivers expressed needs that relate to the fact that special equipment and/or vehicle modifications are needed to accommodate their specific physical disabilities. The problems they report in this survey, together with their ratings of importance of various design considerations, especially access to, from and within vehicles, provide clues for developing and improving vehicle options and design. Their expression of likely interest in a number of potential options such as urban cars, shared ownership, rental/lease vehicles suggest areas of market demand that could be explored. The results also suggest the need for more information on the many aspects related to the self-drive option.

While this report provides the views on the self-drive option of drivers currently licensed to drive with special equipment, it may also be relevant to disabled persons who do not currently drive but who want to and could with the appropriate equipment; and to elderly and other drivers who may benefit from special equipment.

This survey obtained input from the present users of special equipment at the "front-end" of planning and policy development, and is a step in fulfilling the need for user-oriented consultation.

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* Based on this work, The Transportation Development Centre has recently published a consumer or buyer's guide entitled "Vehicles and Adaptive Aids for Elderly and Diabled Drivers" (Cat. No. T48-25-1986E; ISBN:0-660-11937-4) which is available with a charge from the Canadian Government Publishing Centre, Ottawa, Canada K1A 0S9 (telephone: (819) 997-2560).

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APPENDIX A

LIST OF FREQUENCY TABLES FOR HAND CONTROLS GROUP

AND ASSORTED EQUIPMENT GROUP

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TABLE A-1
TYPE OF DISABILITY

	Hand Controls (N = 667)		Assorted Equipment (N = 26)	
	#	%	#	%
Stiff Joints	35	5.2	-	-
Arthritis	35	5.2	2	7.7
Heart Condition	8	1.2	1	3.8
Parkinson's Disease	-	-	-	-
Head Injury	2	0.3	1	3.8
Shortness of Body or Limbs	34	5.1	8	30.8
Muscular Dystrophy	11	1.6	1	-
Stroke	5	0.7	4	15.4
Multiple Sclerosis	26	3.9	-	-
Amputation	63	9.4	8	30.8
Paraplegia	332	49.8	3	11.5
Triplegia	2	0.3	-	-
Quadriplegia	72	10.8	-	-
Hemiplegia	1	0.1	3	11.5
Back/Spine Impairment	54	8.1	5	19.2
Cerebral Palsy	25	3.7	1	3.8
Polio	136	20.4	2	7.7
Spina Bifida	42	6.3	3	11.5
Other	22	3.3	1	3.8
Missing Data	3		-	

TABLE A-2
SIDE OF UPPER BODY LIMITATION

	Hand Controls (N = 136)		Assorted Equipment (N = 14)	
	#	%	#	%
Right Side	13	9.6	3	21.4
Left Side	16	11.8	5	35.7
Both Sides	107	78.7	6	42.9
Not Applicable	452	-	8	-
Missing Data	82		4	

TABLE A-3
NATURE OF UPPER BODY LIMITATION

	Hand Controls (N = 173)		Assorted Equipment (N = 14)	
	#	%	#	%
Short Limbs	13	7.5	1	7.1
Amputation	6	3.5	4	28.6
Difficulty Moving	14	8.1	3	21.4
Paralysis	85	49.1	6	42.9
Coordination	7	4.0	-	-
Spasticity	30	17.3	1	7.1
Muscle Weakness	70	40.5	1	7.1
Other	13	7.5	1	7.1
Missing Data	497		12	

TABLE A-4
PART OF UPPER BODY AFFECTED

	Hand Controls (N = 159)		Assorted Equipment (N = 14)	
	#	%	#	%
Shoulder and Below	88	55.3	11	78.6
Elbow and Below	28	17.6	2	14.3
Wrist and Below	43	27.0	1	7.1
Not Applicable	444	-	8	-
Missing Data	67		4	

TABLE A-1
TYPE OF DISABILITY

	Hand Controls (N = 667)		Assorted Equipment (N = 26)	
	#	%	#	%
Stiff Joints	35	5.2	-	-
Arthritis	35	5.2	2	7.7
Heart Condition	8	1.2	1	3.8
Parkinson's Disease	-	-	-	-
Head Injury	2	0.3	1	3.8
Shortness of Body or Limbs	34	5.1	8	30.8
Muscular Dystrophy	11	1.6	1	-
Stroke	5	0.7	4	15.4
Multiple Sclerosis	26	3.9	-	-
Amputation	63	9.4	8	30.8
Paraplegia	332	49.8	3	11.5
Triplegia	2	0.3	-	-
Quadriplegia	72	10.8	-	-
Hemiplegia	1	0.1	3	11.5
Back/Spine Impairment	54	8.1	5	19.2
Cerebral Palsy	25	3.7	1	3.8
Polio	136	20.4	2	7.7
Spina Bifida	42	6.3	3	11.5
Other	22	3.3	1	3.8
Missing Data	3		-	

TABLE A-2
SIDE OF UPPER BODY LIMITATION

	Hand Controls (N = 136)		Assorted Equipment (N = 14)	
	#	%	#	%
Right Side	13	9.6	3	21.4
Left Side	16	11.8	5	35.7
Both Sides	107	78.7	6	42.9
Not Applicable	452	-	8	-
Missing Data	82		4	

TABLE A-3
NATURE OF UPPER BODY LIMITATION

	Hand Controls (N = 173)		Assorted Equipment (N = 14)	
	#	%	#	%
Short Limbs	13	7.5	1	7.1
Amputation	6	3.5	4	28.6
Difficulty Moving	14	8.1	3	21.4
Paralysis	85	49.1	6	42.9
Coordination	7	4.0	-	-
Spasticity	30	17.3	1	7.1
Muscle Weakness	70	40.5	1	7.1
Other	13	7.5	1	7.1
Missing Data	497		12	

TABLE A-4
PART OF UPPER BODY AFFECTED

	Hand Controls (N = 159)		Assorted Equipment (N = 14)	
	#	%	#	%
Shoulder and Below	88	55.3	11	78.6
Elbow and Below	28	17.6	2	14.3
Wrist and Below	43	27.0	1	7.1
Not Applicable	444	-	8	-
Missing Data	67		4	

TABLE A-5
SEVERITY OF UPPER BODY LIMITATION

	Hand Controls (N = 151)		Assorted Equipment (N = 12)	
	#	%	#	%
Partial Function	124	82.1	7	58.3
No Function	27	17.9	5	41.7
Not Applicable	445	-	8	-
Missing Data	74		6	

TABLE A-6
SIDE OF LOWER BODY LIMITATION

	Hand Controls (N = 601)		Assorted Equipment (N = 19)	
	#	%	#	%
Right Side	17	2.8	10	52.6
Left Side	22	3.7	5	26.3
Both Sides	562	93.5	4	21.2
Not Applicable	17	-	3	-
Missing Data	52		4	

TABLE A-7
NATURE OF LOWER BODY LIMITATION

	Hand Controls (N = 640)		Assorted Equipment (N = 20)	
	#	%	#	%
Short Limbs	37	5.8	3	15.0
Amputation	59	9.2	5	25.0
Difficulty Moving	52	8.1	1	5.0
Paralysis	455	71.1	6	30.0
Coordination	18	2.8	2	10.0
Spasticity	99	15.5	1	5.0
Muscle Weakness	110	17.2	5	25.0
Other	10	1.6	1	5.0
Missing Data	30		6	

TABLE A-8
PART OF LOWER BODY AFFECTED

	Hand Controls (N = 625)		Assorted Equipment (N = 16)	
	#	%	#	%
Hip and Below	572	91.5	13	81.3
Knee and Below	49	7.8	3	18.7
Ankle and Below	4	0.6	-	-
Not Applicable	10	-	4	-
Missing Data	35		6	

TABLE A-9
SEVERITY OF LOWER BODY AFFECTED

	Hand Controls (N = 615)		Assorted Equipment (N = 16)	
	#	%	#	%
Partial Function	248	40.3	11	68.8
No Function	367	59.7	5	31.3
Not Applicable	10	-	4	-
Missing Data	45		6	

TABLE A-10
EXTENT OF NECK MOVEMENT

	Hand Controls (N = 644)		Assorted Equipment (N = 26)	
	#	%	#	%
Limited Movement	33	5.1	1	3.8
Unable to Move	-	-	-	-
Not Affected	611	94.9	25	96.2
Missing Data	26		-	

TABLE A-11
BALANCE

	Hand Controls (N = 653)		Assorted Equipment (N = 25)	
	#	%	#	%
Partly Affected	339	51.9	9	36.0
Completely Affected	80	12.3	-	-
Not Affected	234	35.8	16	64.0
Missing Data	17		1	

TABLE A-12
ASSISTIVE DEVICES

	Hand Controls (N = 646)		Assorted Equipment (N = 17)	
	#	%	#	%
Crutch(es)	146	22.6	2	11.8
Cane(s)	60	9.3	6	35.3
Special Shoe(s)	34	5.3	1	5.9
Leg or Foot Brace	118	18.3	6	35.3
Back Brace	18	2.8	-	-
Walker	18	2.8	-	-
Manual Wheelchair	490	75.9	-	-
Motorized Wheelchair	51	7.9	-	-
Arm or Hand Prosthesis	3	0.5	2	11.8
Leg or Foot Prosthesis	35	5.4	5	29.4
Other	8	1.2	1	5.9
Missing Data	24		9	

TABLE A-13
SEX

	Hand Controls (N = 661)		Assorted Equipment (N = 26)	
	#	%	#	%
Male	487	73.7	18	69.2
Female	174	26.3	8	30.8
Missing Data	9		-	

TABLE A-14
AGE DISTRIBUTION

	Hand Controls (N = 667)		Assorted Equipment (N = 26)	
	#	%	#	%
15-24 years	43	6.4	5	19.2
25-34 years	141	21.1	7	26.9
35-44 years	177	26.5	6	23.1
45-54 years	129	19.3	4	15.4
55-64 years	122	18.3	1	3.8
65+ years	55	8.2	3	11.5
Missing Data	3		-	

TABLE A-15
LIVING ARRANGEMENT

	Hand Controls (N = 663)		Assorted Equipment (N = 26)	
	#	%	#	%
Live Alone	141	21.3	2	7.7
Live with Spouse	363	54.8	14	53.8
Live with Relatives	125	18.9	9	34.6
Live in Shared or Group Accommodation	16	2.4	1	3.8
Other	18	2.7	-	-
Missing Data	7		-	

TABLE A-16
EDUCATION

	Hand Controls (N = 663)		Assorted Equipment (N = 26)	
	#	%	#	%
Grade 8 or Less	76	11.5	3	11.5
High School Degree or Less	282	42.5	11	42.3
College/Technical Degree or Less	144	21.7	9	34.6
University	119	17.9	2	7.7
Post Graduate	42	6.3	1	3.8
Missing Data	7		-	

TABLE A-17
ANNUAL HOUSEHOLD INCOME

	Hand Controls (N = 643)		Assorted Equipment (N = 22)	
	#	%	#	%
Under $10,000	151	23.5	6	27.3
$10,000 - $19,999	155	24.1	6	27.3
$20,000 - $29,999	127	19.8	6	27.3
$30,000 - $39,999	93	14.5	2	9.1
$40,000 and Over	117	18.2	2	9.1
Missing Data	27		4	

TABLE A-18
EMPLOYMENT STATUS

	Hand Controls (N = 666)		Assorted Equipment (N = 26)	
	#	%	#	%
Student	30	4.5	4	15.4
Work Full-Time	263	39.5	11	42.3
Work Part-Time	50	7.5	1	3.8
Unemployed	99	14.9	4	15.4
Unable to Work	94	14.1	2	7.7
Retired	105	15.8	4	15.4
Other	25	3.8	-	-
Missing Data	4		-	

TABLE A-19
TYPE OF LOCATION

	Hand Controls (N = 658)		Assorted Equipment (N = 26)	
	#	%	#	%
Urban	431	65.5	13	50.0
Suburban	93	14.1	7	26.9
Rural	134	20.4	6	23.1
Missing Data	12		-	

TABLE A-20
REGION OF RESIDENCE

	Hand Controls (N = 626)		Assorted Equipment (N = 24)	
	#	%	#	%
Northwest Ontario	35	5.6	2	8.3
Northeast Ontario	26	4.2	2	8.3
Western Ontario	140	22.4	4	16.7
Central Ontario	321	51.3	13	54.2
Eastern Ontario	104	16.6	3	12.5
Missing Data	44		2	

TABLE A-21
REGULAR ACCESS TO VEHICLE

	Hand Controls (N = 668)		Assorted Equipment (N = 26)	
	#	%	#	%
Yes	641	96.0	26	100.0
No	27	4.0	-	-
Missing Data	2		-	

TABLE A-22
REASON FOR NOT DRIVING ON A REGULAR BASIS

	Hand Controls (N = 24)		Assorted Equipment (N = 0)	
	#	%	#	%
Cost	10	41.7	-	-
Disability	5	20.8	-	-
No Vehicle	5	20.8	-	-
Insurance	3	12.5	-	-
Unable to Enter Vehicle by Myself	1	4.2	-	-
Not Applicable	643	-	26	-
Missing Data	3		-	

TABLE A-23
OWNERSHIP OF VEHICLE

	Hand Controls (N = 668)		Assorted Equipment (N = 26)	
	#	%	#	%
Own Vehicle, Only Driver	255	40.3	12	46.2
Own Vehicle, Primary Driver	278	43.9	8	30.8
Share Ownership of Vehicle	39	6.2	1	3.8
Drive Vehicle Owned by Family/Friend	47	7.4	5	19.2
Drive A Company Vehicle	4	0.6	-	-
Lease/Rent Vehicle, Only Driver	6	0.9	-	-
Lease/Rent, Share	4	0.6	-	-
Not Applicable	26	-	-	-
Missing Data	11		-	

TABLE 24A
MEANS OF TRANSPORTATION FOR MONTHLY TRIPS - HAND CONTROLS

	AVERAGE NUMBER OF MONTHLY TRIPS									
	1-10		11-20		21-30		over 30		Not Applicable	
	#	%	#	%	#	%	#	%	#	%
CAR/VAN										
As Driver (N=626)	95	15.2	88	14.1	131	20.9	291	46.5	21	3.4
Missing Data	44									
As Passenger (N=336)	161	47.9	40	11.9	17	5.1	15	4.5	103	30.7
Missing Data	334									
SPECIAL TRANSIT FOR DISABLED PERSONS (N=287)	63	22.0	12	4.2	9	3.1	7	2.4	196	68.3
Missing Data	383									
PUBLIC TRANSIT (N=244)	12	4.9	1	0.4	1	0.4	3	1.2	227	93.0
Missing Data	426									
TAXI (N=263)	56	21.3	3	1.1	1	0.4	-	-	203	77.2
Missing Data	407									

TABLE 24B
MEANS OF TRANSPORTATION FOR MONTHLY TRIPS - ASSORTED EQUIPMENT

	AVERAGE NUMBER OF MONTHLY TRIPS									
	1-10		11-20		21-30		over 30		Not Applicable	
	#	%	#	%	#	%	#	%	#	%
CAR/VAN										
As Driver (N=25)	4	16.0	8	32.0	5	20.0	7	28.0	1	4.0
Missing Data	1									
As Passenger (N=10)	8	80.0	-	-	-	-	-	-	2	20.0
Missing Data	16									
SPECIAL TRANSIT FOR DISABLED PERSONS (N=8)	-	-	-	-	-	-	-	-	8	100.0
Missing Data	18									
PUBLIC TRANSIT (N=10)	1	10.0	2	20.0	-	-	-	-	7	70.0
Missing Data	16									
TAXI (N=8)	2	25.0	-	-	-	-	-	-	6	75.0
Missing Data	18									

TABLE A-25
REASON FOR DRIVING

	Hand Controls (N = 639)		Assorted Equipment (N = 25)	
	#	%	#	%
Job Requirement	42	6.6	1	4.0
No other alternative transportation	116	18.2	4	16.0
No other alternative but if there was would still prefer to drive	200	31.3	7	28.0
Other transportation available but prefer to drive	245	38.3	12	48.0
Other	36	5.6	1	4.0
Missing Data	31		1	

TABLE A-26
DAILY DRIVING

	Hand Controls (N = 643)		Assorted Equipment (N = 26)	
	#	%	#	%
Locally	536	83.4	22	84.6
Between Cities	107	16.6	4	15.4
Missing Data	27		-	

TABLE A-27
ANNUAL MILEAGE

	Hand Controls (N = 625)		Assorted Equipment (N = 26)	
	#	%	#	%
1 - 1,600 km	66	10.3	4	15.4
1,600 - 8,000 km	144	22.5	9	34.6
8,000 - 16,000 km	212	33.2	8	30.8
16,000 - 32,000 km	169	26.4	3	11.5
32,000 km and over	48	7.5	2	7.7
Missing Data	31		-	

TABLE A-28
NUMBER OF YEARS LICENSED TO DRIVE WITH HAND CONTROLS OR ASSORTED EQUIPMENT

	Hand Controls (N = 658)	Assorted Equipment (N = 26)
Mean	15	12
Standard Deviation	11	-
Mode	10	2
Minimum	1	1
Maximum	58	53
Missing Cases	12	-

TABLE A-29
NUMBER OF YEARS DRIVING WITH HAND CONTROLS OR ASSORTED EQUIPMENT

	Hand Controls (N = 670)	Assorted Equipment (N = 26)
Mean	14	12
Standard Deviation	11	11
Mode	10	2
Minimum	0	1
Maximum	58	53
Missing Cases	-	-

TABLE A-30
NUMBER OF YEARS DRIVING WITHOUT HAND CONTROLS OR ASSORTED EQUIPMENT

	Hand Controls (N = 668)	Assorted Equipment (N = 26)
Mean	8	7
Standard Deviation	11	12
Mode	0	0
Minimum	0	0
Maximum	56	40
Missing Data	2	-

TABLE A-31
AVAILABILITY OF "HANDICAPPED ONLY" DESIGNATED PARKING SPACES

	Hand Controls (N = 635)		Assorted Equipment (N = 26)	
	#	%	#	%
Very Satisfied	54	8.5	2	7.7
Satisfied	272	42.8	17	65.4
Dissatisfied	200	31.5	3	11.5
Very Dissatisfied	103	16.2	2	7.7
No Opinion	6	0.9	-	-
Not Applicable	-	-	2	7.7
Missing Data	35		-	

TABLE A-32
ENFORCEMENT OF PARKING PROVISIONS FOR "HANDICAPPED DRIVERS"

	Hand Controls (N = 634)		Assorted Equipment (N = 26)	
	#	%	#	%
Very Satisfied	23	3.6	2	7.7
Satisfied	84	13.2	1	3.8
Dissatisfied	171	27.0	9	34.6
Very Dissatisfied	345	54.4	11	42.3
No Opinion	11	1.7	-	-
Not Applicable	-	-	3	11.5
Missing Data	36		-	

TABLE A-33
OPTIONS FOR PARKING THE VEHICLE

	Hand Controls (N = 581)		Assorted Equipment (N = 24)	
	#	%	#	%
Very Satisfied	20	3.4	1	4.2
Satisfied	203	35.9	7	29.2
Dissatisfied	187	32.2	6	25.0
Very Dissatisfied	98	16.9	-	-
No Opinion	66	11.4	5	20.8
Not Applicable	7	1.2	5	20.8
Missing Data	89		2	

TABLE A-34
AVAILABILITY OF SPECIAL DRIVER TRAINING PROGRAMS FOR DISABLED DRIVERS

	Hand Controls (N = 611)		Assorted Equipment (N = 26)	
	#	%	#	%
Very Satisfied	40	6.5	2	7.7
Satisfied	126	20.6	9	34.6
Dissatisfied	68	11.1	1	3.8
Very Dissatisfied	45	7.4	-	-
No Opinion	213	34.9	8	30.8
Not Applicable	119	19.5	6	23.1
Missing Data	59		-	

TABLE A-35
QUALITY OF SPECIAL DRIVER TRAINING PROGRAMS FOR DISABLED DRIVERS

	Hand Controls (N = 607)		Assorted Equipment (N = 26)	
	#	%	#	%
Very Satisfied	61	10.0	6	23.1
Satisfied	109	18.0	3	11.5
Dissatisfied	39	6.4	1	3.8
Very Dissatisfied	25	4.1	-	-
No Opinion	245	40.4	10	38.5
Not Applicable	128	21.1	6	23.1
Missing Data	63		-	

TABLE A-36
AVAILABILITY OF PROFESSIONAL ASSESSMENT OF DRIVING ABILITY AND NEEDS

	Hand Controls (N = 607)		Assorted Equipment (N = 26)	
	#	%	#	%
Very Satisfied	37	6.1	3	11.5
Satisfied	139	22.9	5	19.2
Dissatisfied	68	11.2	1	3.8
Very Dissatisfied	40	6.6	-	-
No Opinion	219	36.1	10	38.5
Not Applicable	104	17.1	7	26.9
Missing Data	63		-	

TABLE A-37
QUALITY OF PROFESSIONAL ASSESSMENT OF DRIVING ABILITY AND NEEDS

	Hand Controls (N = 606)		Assorted Equipment (N = 26)	
	#	%	#	%
Very Satisfied	58	9.6	6	23.1
Satisfied	154	25.4	5	19.2
Dissatisfied	51	8.4	-	-
Very Dissatisfied	24	4.0	3	11.5
No Opinion	211	34.8	7	26.9
Not Applicable	108	17.8	5	19.2
Missing Data	64		-	

TABLE A-38
LICENSING REQUIREMENTS AND PROCEDURES

	Hand Controls (N = 623)		Assorted Equipment (N = 26)	
	#	%	#	%
Very Satisfied	103	16.5	5	19.2
Satisfied	398	63.9	12	46.2
Dissatisfied	38	6.1	3	11.5
Very Dissatisfied	30	4.8	-	-
No Opinion	48	7.7	3	11.5
Not Applicable	6	1.0	3	11.5
Missing Data	47		-	

TABLE A-39
AVAILABILITY OF VEHICLE INSURANCE

	Hand Controls (N = 625)		Assorted Equipment (N = 26)	
	#	%	#	%
Very Satisfied	140	22.4	9	34.6
Satisfied	339	54.2	9	34.6
Dissatisfied	62	9.9	3	11.5
Very Dissatisfied	63	10.1	1	3.8
No Opinion	21	3.4	1	3.8
Not Applicable	-	-	3	11.5
Missing Data	45		-	

TABLE A-40
SATISFACTION WITH PROVINCIAL DISABLED SYMBOL LICENCE PLATES

	Hand Controls (N = 643)		Assorted Equipment (N = 26)	
	#	%	#	%
Satisfied	417	64.9	17	65.4
Not Satisfied	146	22.7	2	7.7
No Opinion	64	10.0	4	15.4
Not Eligible	16	2.5	3	11.5
Missing Data	27		-	

TABLE A-41
REASON FOR DISSATISFACTION WITH DISABLED SYMBOL LICENCE PLATES

	Hand Controls (N = 172)		Assorted Equipment (N = 3)	
	#	%	#	%
Too Easy to Obtain	57	33.1	-	-
Label Driver as Disabled-Safety Risk	42	24.4	1	33.3
Implies Disabled Driver Requires Special Consideration	28	16.3	-	-
Others Don't Recognize or Care	11	6.4	-	-
Not Aware of Requirements	6	3.5	2	66.7
Not Portable	4	2.3	-	-
Not Available Where I Live	3	1.7	-	-
Other	21	12.2	-	-
Missing Data	498		23	

TABLE A-42
SATISFACTION WITH SPECIAL MUNICIPAL PARKING PERMITS

	Hand Controls (N = 636)		Assorted Equipment (N = 26)	
	#	%	#	%
Satisfied	302	47.5	12	46.2
Not Satisfied	167	26.3	4	15.4
No Opinion	134	21.1	6	23.1
Not Eligible	33	5.2	4	15.4
Missing Data	34		-	

TABLE A-43
REASON FOR DISSATISFACTION WITH SPECIAL MUNICIPAL PARKING PERMITS

	Hand Controls (N = 218)		Assorted Equipment (N = 6)	
	#	%	#	%
Not Universally Recognized by All Municipalities	54	24.8	-	-
Not Available in All Municipalities	33	15.1	-	-
Not Aware of Them	26	11.9	3	50.0
Still Get Ticketed	22	10.1	-	-
Too Easy to Obtain	20	9.2	-	-
Restrictions for Eligibility	6	2.8	1	16.7
No Enforcement of Provisions	3	1.4	-	-
Other	54	24.8	2	33.3
Missing Data	452		20	

TABLE A-44
TYPE OF VEHICLE DRIVEN

	Hand Controls (N = 644)		Assorted Equipment (N = 26)	
	#	%	#	%
Passenger Car	470	73.0	22	84.6
Station Wagon	41	6.4	2	7.7
Mini Van	11	1.7	-	-
Regular Van	102	15.8	1	3.8
Truck	16	2.5	1	3.8
Other	4	0.6	-	-
Missing Data	26		-	

TABLE A-45
VEHICLE MAKE

	Hand Controls (N = 623)		Assorted Equipment (N = 23)	
	#	%	#	%
General Motors	323	51.8	10	38.5
Chrysler	121	19.4	5	19.2
Ford	136	21.8	4	15.4
Hyundai	12	1.9	3	11.5
Toyota	9	1.4	-	-
AMC	5	0.8	1	3.8
Honda	3	0.5	-	-
Volkswagen	2	0.3	-	-
Other	12	1.9	-	-
Missing Data	47		1	

TABLE A-46
AGE OF VEHICLE

	Hand Controls (N = 634)		Assorted Equipment (N = 24)	
	#	%	#	%
New	32	5.0	4	16.7
1 - 2 years	128	20.2	2	8.3
3 - 4 years	91	14.4	3	12.5
5 - 6 years	127	20.0	7	29.2
Over 6 years	256	40.4	8	33.3
Missing Data	36		2	

TABLE A-47
NUMBER OF DOORS

	Hand Controls (N = 506)		Assorted Equipment (N = 24)	
	#	%	#	%
2-door	322	63.6	7	29.2
4-door	184	36.4	17	70.8
Missing Data	164		2	

TABLE A-48
TYPE OF SIDE DOORS ON VANS

	Hand Controls (N = 130)		Assorted Equipment (N = 1)	
	#	%	#	%
Swing Doors	26	20.0	1	100.0
Sliding Doors	104	80.0	-	-
Missing Data	540		25	

TABLE A-49
DRIVER'S SEAT

	Hand Controls (N = 620)		Assorted Equipment (N = 26)	
	#	%	#	%
Bench	170	27.4	8	30.8
Bucket	259	41.8	14	53.8
Split Bench	165	26.6	4	15.4
Wheelchair	26	4.2	-	-
Missing Data	50		-	

TABLE A-50
FACTORY OPTIONS

	Hand Controls (N = 644)		Assorted Equipment (N = 26)	
	#	%	#	%
Automatic Transmission	638	99.1	25	96.2
Power Steering	616	95.7	24	92.3
Power Brakes	614	95.3	24	92.3
Adjustable Seats	471	73.1	21	80.8
Power Seats	105	16.3	3	11.5
Power Windows	186	28.9	3	11.5
Cruise Control	245	38.0	7	26.9
Power Locks	139	21.6	4	15.4
Power Trunk	153	23.8	2	7.7
Adjustable Steering Column	31	4.8	1	3.8
Tilt Steering	190	29.5	8	30.8
Air Conditioning	258	40.1	4	15.4
Left Remote Mirror	360	55.9	15	57.7
Right Remote Mirror	179	27.8	8	30.8
Rear Defroster	471	73.1	21	80.8
Missing Data	26		-	

TABLE A-51
PRICE PAID FOR VEHICLE

	Hand Controls (N = 589)		Assorted Equipment (N = 20)	
	#	%	#	%
Under $5,000	119	20.2	3	15.0
$ 5,000 - $ 9,999	193	32.8	9	45.0
$10,000 - $14,999	167	28.4	7	35.0
$15,000 - $19,999	85	14.4	1	-
$20,000 - $24,999	17	2.9	-	-
$25,000 - $29,999	4	0.7	-	-
$30,000 and over	4	0.7	-	-
Missing Data	81		6	

TABLE A-52
MOBILITY ALLOWANCE OR FINANCIAL ASSISTANCE TO PURCHASE AND/OR CONVERT VEHICLE

	Hand Controls (N = 633)		Assorted Equipment (N = 25)	
	#	%	#	%
Yes	146	23.1	3	12.0
No	477	75.4	18	72.0
Not Applicable	10	1.6	4	16.0
Missing Data	37		1	

TABLE A-53
FINANCIAL SOURCE

	Hand Controls (N = 146)		Assorted Equipment (N = 4)	
	#	%	#	%
Government Agency	100	68.5	3	75.0
Private Insurance	20	13.7	1	25.0
Private Sources (i.e. family trust fund)	14	9.6	-	-
Other (i.e. service club, community service organization)	23	15.8	-	-
Missing Data	524		22	

TABLE A-54
1985 VEHICLE INSURANCE

	Hand Controls (N = 559)		Assorted Equipment (N = 17)	
	#	%	#	%
$ 170 - 299	45	8.1	-	-
$ 300 - 399	93	16.6	3	17.6
$ 400 - 499	137	24.5	7	41.2
$ 500 - 599	107	19.1	2	11.8
$ 600 - 699	71	12.7	1	5.9
$ 700 - 799	25	4.5	1	5.9
$ 800 - 899	17	3.0	1	5.9
$ 900 - 999	17	3.0	-	-
$1,000 - 1,999	38	6.8	2	11.8
$2,000 and over	9	1.6	-	-
Missing Data	111		3	

TABLE A-55
ARE THERE VEHICLE FEATURES THAT FAIL TO MEET YOUR DRIVING NEEDS?

	Hand Controls (N = 631)		Assorted Equipment (N = 24)	
	#	%	#	%
Yes	96	15.2	10	41.7
No	535	84.8	14	58.3
Missing Data	39		2	

TABLE A-56
VEHICLE FEATURES WHICH POSE PROBLEMS

	Hand Controls (N = 95)		Assorted Equipment (N = 12)	
	#	%	#	%
Not enough room behind driver's [illegible]	15	15.8	-	-
Foot operated secondary controls	10	10.5	-	-
Poor location of primary and secondary controls	10	10.5	6	
Longer tracks needed for seats	5	5.3	1	11.1
Hump in middle of floor makes entry difficult	5	5.3	-	-
Not enough leg room	3	3.2	-	-
Poor wheelchair lock system	2	2.1	-	-
Other	45	47.4	5	66.7
Missing Data	575	-	14	

TABLE A-57
NATURE OF STRUCTURAL CONVERSION(S)*

	Hand Controls (N = 55)	
	#	%
Power Ran	8	14.5
Wheelchair Channels	8	14.5
Raised Roof	36	65.5
Dropped Floor	2	3.6
Raised Side Door	6	10.9
Other	9	16.4
Missing Data	615	

TABLE A-58
REGION WHERE VEHICLE STRUCTURALLY CONVERTED*

	Hand Controls (N = 53)	
	#	%
Ontario	49	92.5
Other Province	-	-
U.S.A.	4	7.5
Missing Data	617	

* (There were no reported structural conversions in the special equipment group.)

TABLE A-59
PLACE WHERE VEHICLE WAS CONVERTED*

	Hand Controls (N = 52) #	%
Cambridge	1	1.9
Kitchener	2	3.8
London	3	5.8
Markham	2	3.8
Mississauga	1	1.9
Ottawa	4	7.7
Sudbury	1	1.9
Thunder Bay	3	5.8
Toronto	18	34.6
Welland	4	7.7
Winchester	1	1.9
Other	8	15.4
Michigan	2	3.8
Connecticut	1	1.9
Wisconsin	1	1.9
Missing Data	618	

TABLE A-60
VEHICLE CONVERTER*

	Hand Controls (N = 53) #	%
Company specializing in vehicle conversions	40	75.5
Dealership	8	15.1
Licensed Auto Mechanic	4	7.5
Personal Contact (family/friend)	3	5.7
Other	4	7.5
Missing Data	617	

TABLE A-61
AGE OF VEHICLE WHEN STRUCTURALLY CONVERTED*

	Hand Controls (N = 53) #	%
New	42	79.2
1 - 3 years	7	13.2
4 - 5 years	3	5.7
Over 5 years	1	1.9
Missing Data	617	

TABLE A-62
PRICE PAID FOR VEHICLE CONVERSIONS*

	Hand Controls (N = 37) #	%
$ 1 - 999	2	5.4
$ 1,000 - 1,999	5	13.5
$ 2,000 - 3,999	6	16.2
$ 4,000 - 5,999	5	13.5
$ 6,000 - 7,999	5	13.5
$ 8,000 - 9,999	6	16.2
$10,000 - 11,999	4	10.8
$12,000 - 14,999	1	2.7
$15,000 - 19,999	2	5.4
$20,000 and over	1	2.7
Missing Data	633	

* (There were no reported structural conversions in the special equipment group.)

TABLE A-63
FREQUENCY OF PROBLEMS*

	Hand Controls (N = 16)		
	Users #	Users with #	Proolems %
Raised Roof	36	5	13.9
Power Pan	8	3	37.5
Wheel Channels	8	3	37.5
Raised Side Door	6	2	33.3
Dropped Floor	3	-	-
Other	9	2	22.2

TABLE A-64
SAFETY OF STRUCTURAL CONVERSION(S)*

	Hand Controls (N = 50)	
	#	%
Very Satisfied	20	40.0
Satisfied	26	52.0
Dissatisfied	3	6.0
Very Dissatisfied	-	-
No Opinion	1	2.0
Missing Data	620	

TABLE A-65
SERVICE/MAINTENANCE OF VEHICLE AND PARTS*

	Hand Controls (N = 52)	
	#	%
Very Satisfied	14	26.9
Satisfied	24	46.2
Dissatisfied	7	13.5
Very Dissatisfied	5	9.6
No Opinion	2	3.8
Missing Data	618	

TABLE A-66
QUALITY OF WORK IN STRUCTURAL CONVERSION(S)*

	Hand Controls (N = 51)	
	#	%
Very Satisfied	16	31.4
Satisfied	24	47.1
Dissatisfied	7	13.7
Very Dissatisfied	3	5.9
No Opinion	1	2.0
Missing Data	619	

TABLE A-67
NUMBER OF CONTRACTORS AVAILABLE FOR STRUCTURAL CONVERSION(S)*

	Hand Controls (N = 51)	
	#	%
Very Satisfied	3	5.9
Satisfied	11	21.6
Dissatisfied	17	33.3
Very Dissatisfied	14	27.5
No Opinion	6	11.8
Missing Data	619	

* (There were no reported structural conversions in the special equipment group.)

TABLE A-68
TIME REQUIRED TO ARRANGE FOR STRUCTURAL CONVERSION(S)*

	Hand Controls (N = 50)	
	#	%
Very Satisfied	3	6.0
Satisfied	24	48.0
Dissatisfied	13	26.0
Very Dissatisfied	7	14.0
No Opinion	3	6.0
Missing Data	620	

TABLE A-69
TIME REQUIRED TO COMPLETE STRUCTURAL CONVERSION(S)*

	Hand Controls (N = 51)	
	#	%
Very Satisfied	3	5.9
Satisfied	23	45.1
Dissatisfied	15	29.4
Very Dissatisfied	6	11.8
No Opinion	4	7.8
Missing Data	619	

TABLE A-70
AVAILABILITY OF INFORMATION ON STRUCTURAL CONVERSION(S)*

	Hand Controls (N = 52)	
	#	%
Very Satisfied	3	5.8
Satisfied	13	25.0
Dissatisfied	18	34.6
Very Dissatisfied	13	25.0
No Opinion	5	9.6
Missing Data	618	

TABLE A-71
COST OF STRUCTURAL CONVERSION(S)*

	Hand Controls (N = 46)	
	#	%
Very Satisfied	3	6.5
Satisfied	10	21.7
Dissatisfied	9	19.6
Very Dissatisfied	18	39.1
No Opinion	6	13.0
Missing Data	624	

TABLE A-72
USE OF ADAPTIVE DRIVING AIDS

	Hand Controls (N = 670)		Assorted Equipment (N = 26)	
	#	%	#	%
Steering Aids	205	30.6	13	50.0
Acceleration/Braking Aids	608	90.7	18	69.2
Control Lever Aids	200	29.9	5	19.2
Vision Aids	344	51.3	7	26.9
Safety Aids	234	34.9	6	23.1
Entry/Exit Aids	166	24.8	3	11.5

* (There were no reported structural conversions in the special equipment group.)

TABLE A-73*
STEERING AIDS

	Hand Controls (N = 205)			Assorted Equipment (N = 13)		
	Users	Users with Problems		Users	Users with Problems	
	#	#	%	#	#	%
Reduced Effort Steering	39	5	12.8	2	-	-
Emergency Steering Backup	8	3	37.5	-	-	-
Steering Column Extension	17	-	-	-	-	-
Steering Column Adjuster	12	-	-	1	-	-
Modified Steering Wheel	17	1	5.9	1	-	-
Horizontal Steering	2	-	-	-	-	-
Spinner Knob, Tri-Pin, Etc.	175	23	13.1	10	3	30.0
Foot Steering	1	-	-	-	-	-
Other	1	1	100.0	-	-	-
Missing Data	465			13		

TABLE A-74*
ACCELERATION/BRAKING AIDS

	Hand Controls (N = 608)			Assorted Equipment (N = 18)		
	Users	Users with Problems		Users	Users with Problems	
	#	#	%	#	#	%
Reduced Effort Braking/Acceleration	43	3	2.3	2	-	-
Hand Controls	590	68	11.5	1	-	-
Hand Clutch Control	5	1	20.0	-	-	-
Left-Hand Gear Selector	3	-	-	-	-	-
Gear Selector on Floor	9	-	-	-	-	-
Left-Foot Gas Pedal	9	2	22.2	12	4	33.3
Pedal Extensions	9	-	-	6	1	16.7
Parking Brake Extension Levers	80	12	15.0	-	-	-
Electric Parking Brake	10	4	40.0	-	-	-
Other	4	-	-	-	-	-
Missing Data	62			8		

TABLE A-75*
CONTROL LEVER/AIDS

	Hand Controls (N = 200)			Assorted Equipment (N = 5)		
	Users	Users with Problems		Users	Users with Problems	
	#	#	%	#	#	%
Keyless Ignition	6	3	50.0	-	-	-
Remote Starter	3	1	33.3	-	-	-
Right Side Turn Signal	20	1	5.0	2	1	50.0
Gear Selector Extension Lever	8	-	-	-	-	-
Powered Gear Selector	4	2	50.0	-	-	-
Remote Secondary Controls (i.e. horn, wiper/washer)	96	9	9.4	2	-	-
Remote Dimmer Switch	144	11	8.0	1	-	-
Dashboard Extensions/Rings	5	1	20.0	-	-	-
Centre or Door Console	18	4	22.2	-	-	-
Other	5	1	20.0	-	-	-
Missing Data	470			21		

* See Table A-110 for a list of the specific problems reported.

TABLE A-76*
VISION AIDS

	Hand Controls (N = 344)			Assorted Equipment (N = 7)		
	Users	Users with Problems		Users	Users with Problems	
	#	#	%	#	#	%
Right Side Mounted Convex Rear View Mirror	193	14	7.3	4	-	-
Left Side Mounted Convex Rear View Mirror	224	8	3.6	3	-	-
Full Range Rear View Mirror	155	1	0.6	3	-	-
Dual Mirrors	121	9	7.4	3	-	-
Other	6	-	-	-	-	-
Missing Data	326			19		

TABLE A-77*
SAFETY AIDS

	Hand Controls (N = 234)			Assorted Equipment (N = 6)		
	Users	Users with Problems		Users	Users with Problems	
	#	#	%	#	#	%
Safety Torso Restraints/Chest Harness	140	21	15.0	4	3	75.0
Wheelchair Restraints	22	4	18.2	-	-	-
2-Way Radio	117	11	9.4	2	-	-
Car Telephone	11	-	-	-	-	-
Fire Extinguisher	44	-	-	-	-	-
Other	7	-	-	-	-	-
Missing Data	436			20		

TABLE A-78*
ENTRY/EXIT AIDS

	Hand Controls (N = 166)			Assorted Equipment (N = 3)		
	Users	Users with Problems		Users	Users with Problems	
	#	#	%	#	#	%
Automatic Doors	86	22	25.6	1	-	-
Automatic Lift	103	30	29.1	-	-	-
Removable Seat Base	11	1	9.1	1	-	-
Track Seating	35	6	17.1	-	-	-
Transfer Aids	46	1	2.2	-	-	-
Remote Control Door/Lift	32	1	3.1	-	-	-
Removable Floor Insert Boards	14	-	-	2	-	-
Other	5	2	40.0	1	-	-
Missing Data	504			23		

TABLE A-79
PRICE PAID FOR ADAPTIVE DRIVING AIDS

	Hand Controls (N = 528)		Assorted Equipment (N = 16)	
	#	%	#	%
$ 1 - 250	189	35.8	16	94.1
$ 251 - 500	240	45.5	1	5.9
$ 501 - 750	21	4.0	-	-
$ 751 - 1000	6	1.1	-	-
$1001 - 3000	9	1.7	-	-
$3001 - 5000	33	6.3	-	-
$5001 - 7000	16	3.0	-	-
$7001 - 9000	8	1.6	-	-
over $9000	6	1.1	-	-
Missing Data	142		9	

* See Table A-110 for a list of the specific problems reported.

TABLE A-80
REGION WHERE ADAPTIVE AIDS WERE PURCHASED

	Hand Control* (N = 568)		Assorted Equipment (N = 16)	
	#	%	#	%
Ontario	430	75.7	13	81.3
Other Province	71	12.5	2	12.5
U.S.A.	67	11.8	1	6.3
Missing Data	102		10	

TABLE A-81
PLACE WHERE ADAPTIVE AIDS WERE PURCHASED

	Hand Controls (N = 520)		Assorted Equipment (N = 16)	
	#	%	#	%
Cambridge	1	0.2	-	-
Kingston	5	1.0	-	-
Kitchener	11	2.1	-	-
London	27	5.2	-	-
Markham	10	1.9	-	-
Mississauga	13	2.5	-	-
Ottawa	19	3.7	1	6.3
Peterborough	3	0.6	-	-
Sudbury	2	0.4	-	-
Thunder Bay	8	1.5	-	-
Toronto	202	38.8	5	31.3
Waterloo	1	0.2	-	-
Welland	13	2.5	2	12.5
Winchester	4	0.8	-	-
Windsor	2	0.4	-	-
Other Cities in Ontario	66	12.7	5	31.3
British Columbia	51	9.8	1	6.3
Quebec	11	2.1	1	6.3
Manitoba	2	0.4	-	-
Alberta	2	0.4	-	-
New Brunswick	2	0.4	-	-
Saskatchewan	1	0.2	-	-
Ohio	5	1.0	-	-
Michigan	37	7.1	1	6.3
Connecticut	5	1.0	-	-
California	10	1.9	-	-
Other State	7	1.3	-	-
Missing Data	150		10	

TABLE A-82
INSTALLER OF ADAPTIVE DRIVING AIDS

	Hand Controls (N = 586)		Assorted Equipment (N = 19)	
	#	%	#	%
Equipment Vendor	217	37.0	1	5.3
Equipment Manufacturer	47	8.0	-	-
Licensed Auto Mechanic	181	30.9	8	42.1
Personal Contact	115	19.6	7	36.8
Yourself	57	9.7	4	21.1
Other	23	3.9	3	15.8
Missing Data	84		7	

TABLE A-83
ADAPTIVE DRIVING AIDS REUSABLE

	Hand Controls (N = 595)		Assorted Equipment (N = 21)	
	#	%	#	%
Yes	472	79.3	18	85.7
No	69	11.6	2	9.5
Don't Know	54	9.1	1	4.8
Missing Data	75		5	

* See Table A-110 for a list of the specific problems reported.

TABLE A-84
SAFETY OF ADAPTIVE DRIVING AIDS

	Hand Controls (N = 574)		Assorted Equipment (N = 18)	
	#	%	#	%
Very Satisfied	291	50.7	10	55.6
Satisfied	245	42.7	6	33.3
Dissatisfied	21	3.7	2	11.1
Very Dissatisfied	7	1.2	-	-
No Opinion	10	1.7	-	-
Missing Data	96		8	

TABLE A-85
SERVICE/MAINTENANCE OF EQUIPMENT

	Hand Controls (N = 556)		Assorted Equipment (N = 15)	
	#	%	#	%
Very Satisfied	204	36.7	9	60.0
Satisfied	213	38.3	3	20.0
Dissatisfied	63	11.3	1	6.7
Very Dissatisfied	19	3.4	-	-
No Opinion	57	10.3	2	13.3
Missing Data	114		11	

TABLE A-86
QUALITY OF INSTALLATION

	Hand Controls (N = 579)		Assorted Equipment (N = 17)	
	#	%	#	%
Very Satisfied	276	47.7	12	70.6
Satisfied	246	42.5	4	23.5
Dissatisfied	28	4.8	-	-
Very Dissatisfied	14	2.4	-	-
No Opinion	15	2.6	1	5.9
Missing Data	91		9	

TABLE A-87
NUMBER OF QUALIFIED INSTALLERS AVAILABLE

	Hand Controls (N = 543)		Assorted Equipment (N = 16)	
	#	%	#	%
Very Satisfied	61	11.2	5	50.0
Satisfied	121	22.3	3	25.0
Dissatisfied	145	26.7	2	12.5
Very Dissatisfied	109	20.1	-	-
No Opinion	107	19.7	2	12.5
Missing Data	127		10	

TABLE A-88
TIME REQUIRED TO ARRANGE FOR INSTALLATION(S)

	Hand Controls (N = 544)		Assorted Equipment (N = 16)	
	#	%	#	%
Very Satisfied	116	21.3	8	50.0
Satisfied	251	46.1	4	25.0
Dissatisfied	60	11.0	2	12.5
Very Dissatisfied	44	8.1	-	-
No Opinion	73	13.4	2	12.5
Missing Data	126		10	

TABLE A-89
TIME TAKEN TO INSTALL ADAPTIVE DRIVING AID(S)

	Hand Controls (N = 550)		Assorted Equipment (N = 16)	
	#	%	#	%
Very Satisfied	131	23.8	8	50.0
Satisfied	277	50.4	6	37.5
Dissatisfied	55	10.0	1	6.3
Very Dissatisfied	35	6.4	-	-
No Opinion	52	9.5	1	6.3
Missing Data	120		10	

TABLE A-90
AVAILABILITY OF INFORMATION ON ADAPTIVE DRIVING AID(S)

	Hand Controls (N = 557)		Assorted Equipment (N = 17)	
	#	%	#	%
Very Satisfied	57	10.2	3	17.6
Satisfied	154	27.6	2	11.8
Dissatisfied	148	26.6	6	35.3
Very Dissatisfied	129	23.2	3	17.6
No Opinion	69	12.4	3	17.6
Missing Data	113		9	

TABLE A-91
COST OF ADAPTIVE DRIVING AID(S)

	Hand Controls (N = 550)		Assorted Equipment (N = 16)	
	#	%	#	%
Very Satisfied	53	9.6	3	18.8
Satisfied	177	32.2	4	25.0
Dissatisfied	116	21.1	2	12.5
Very Dissatisfied	154	28.0	4	25.0
No Opinion	50	9.1	3	18.8
Missing Data	120		10	

TABLE A-92
SOURCE OF INFORMATION

	Hand Controls (N = 616)		Assorted Equipment (N = 24)	
	#	%	#	%
Personal Contacts	249	40.4	9	37.5
Professional Help	190	30.8	5	20.8
Special Organization	134	21.8	3	12.5
Manufacturer/Dealer	106	17.2	1	4.2
Magazines Articles, Brochures	96	15.6	2	8.3
Exhibitions	15	2.4	1	4.2
Other	46	7.5	5	20.8
Missing Data	54		2	

TABLE A-93
PREFERRED SIZE OF FUTURE VEHICLE

	Hand Controls (N = 657)		Assorted Equipment (N = 26)	
	#	%	#	%
Subcompact Car	18	2.7	2	7.7
Compact Car	70	10.7	8	30.8
Intermediate Car	204	31.1	9	34.6
Large Car	128	19.5	3	11.5
Mini Van	87	13.2	3	11.5
Regular Van	134	20.4	-	-
Other	16	2.4	1	3.8
Missing Data	13		-	

TABLE A-94
PREFERRED NUMBER OF DOORS

	Hand Controls (N = 460)		Assorted Equipment (N = 25)	
	#	%	#	%
2-Door Model	299	65.0	8	32.0
4-Door Model	161	35.0	17	68.0
Missing Data	210		1	

TABLE A-95
PREFERRED VAN DOORS

	Hand Controls (N = 238)		Assorted Equipment (N = 3)	
	#	%	#	%
Swing Doors	51	21.4	2	66.7
Sliding Doors	187	78.6	1	33.3
Missing Data	432		23	

TABLE A-96
PREFERRED DRIVER'S SEAT

	Hand Controls (N = 639)		Assorted Equipment (N = 24)	
	#	%	#	%
Bucket	311	48.7	17	70.8
Split Bench	156	24.4	2	8.3
Bench	109	17.1	5	20.8
Wheelchair	63	9.9	-	-
Missing Data	31		2	

TABLE A-97
PREFERRED FACTORY OPTIONS

	Hand Controls (N = 408)		Assorted Equipment (N = 15)	
	#	%	#	%
Automatic Transmission	193	47.3	12	80.0
Power Steering	296	72.5	11	73.3
Power Brakes	286	70.1	11	73.3
Adjustable Seats	47	11.5	2	13.3
Power Seats	96	23.5	2	13.3
Power Windows	169	41.4	6	40.0
Cruise Control	170	41.7	4	26.7
Power Locks	121	29.7	5	33.3
Power Trunk	59	14.5	1	6.7
Adjustable Steering Column	29	7.1	2	13.3
Tilt Steering	96	23.5	5	33.3
Air Conditioning	157	38.5	4	26.7
Left Remote Mirror	98	24.0	4	26.7
Right Remote Mirror	93	22.8	4	26.7
Rear Defroster	108	26.5	5	33.3
Missing Data	262		11	

TABLE A-98
PREFERRED VEHICLE FEATURES

	Hand Controls (N = 643)		Assorted Equipment (N = 25)	
	#	%	#	%
Access	469	72.9	14	56.0
Size	269	41.8	15	60.0
Head/Leg Room	230	35.8	9	36.0
Wide Doors	208	32.3	3	12.0
Seats	203	31.6	11	44.0
Appearance	195	30.3	7	28.0
Storage	144	22.4	4	16.0
Height	98	15.2	3	12.0
Other	59	9.2	5	20.0
Missing Data	27		1	

TABLE A-99
PRICE WILLING TO PAY FOR NEXT VEHICLE

	Hand Controls (N = 635)		Assorted Equipment (N = 26)	
	#	%	#	%
Under $10,000	146	23.0	9	34.6
$10,000 - $14,999	276	43.5	14	53.8
$15,000 - $19,999	138	21.7	3	11.5
$20,000 - $24,999	46	7.2	-	-
$25,000 - $29,999	19	3.0	-	-
$30,000 and Over	10	1.6	-	-
Missing Data	35		-	

TABLE A-100
WILLING TO PAY PREMIUM FOR CAR WHICH CAN BE DRIVEN FROM WHEELCHAIR

	Hand Controls (N = 464)		Assorted Equipment (N = 0)	
	#	%	#	%
Yes	159	34.3	-	-
No	214	46.1	-	-
Don't Know	91	19.6	-	-
Missing Data	206		26	

TABLE A-101
WILLING TO PAY ADDITIONAL AMOUNT FOR VAN WHICH DOES NOT REQUIRE LIFT OR RAISED ROOF

	Hand Controls (N = 439)		Assorted Equipment (N = 3)	
	#	%	#	%
Yes	181	41.2	-	-
No	181	41.2	-	-
Don't Know	77	17.5	-	-
Missing Data	231		26	

TABLE A-102
PURCHASE OF NEXT VEHICLE

	Hand Controls (N = 641)		Assorted Equipment (N = 23)	
	#	%	#	%
Within 1 Year	108	18.8	6	26.1
Within 2 Years	145	25.3	4	17.4
Within 3 Years	134	23.4	4	17.4
Within 4 to 5 Years	108	18.8	6	26.1
Over 5 Years	78	13.6	3	13.0
Not Applicable	68	-	2	-
Missing Data	29		1	

TABLE A-103
VEHICLE WHICH CANNOT BE IDENTIFIED AS VEHICLE FOR DISABLED DRIVERS

	Hand Controls (N = 613)		Assorted Equipment (N = 23)	
	#	%	#	%
Very Interested	263	42.9	5	21.7
Interested	171	27.9	6	26.1
Not Very Interested	85	13.9	4	17.4
Not At All Interested	62	10.1	4	17.4
No Opinion	32	5.2	4	17.4
Missing Data	57		3	

TABLE A-104
ELECTRIC CAR

	Hand Controls (N = 591)		Assorted Equipment (N = 22)	
	#	%	#	%
Very Interested	57	9.6	1	4.5
Interested	137	23.2	6	27.3
Not Very Interested	159	26.9	3	13.6
Not At All Interested	203	34.3	9	40.9
No Opinion	35	5.9	3	13.6
Missing Data	79		4	

TABLE A-105
SHARED OWNERSHIP OF VEHICLE

	Hand Controls (N = 583)		Assorted Equipment (N = 22)	
	#	%	#	%
Very Interested	35	6.0	1	4.5
Interested	60	10.3	3	13.6
Not Very Interested	71	12.2	3	13.6
Not At All Interested	383	65.7	13	59.1
No Opinion	34	5.8	2	9.1
Missing Data	87		4	

TABLE A-106
AVAILABILITY OF RENTAL OR LEASED VEHICLES

	Hand Controls (N = 586)		Assorted Equipment (N = 21)	
	#	%	#	%
Very Interested	113	19.3	1	4.8
Interested	139	23.7	3	14.3
Not Very Interested	75	12.8	5	23.8
Not At All Interested	221	37.7	10	47.6
No Opinion	38	6.5	2	9.5
Missing Data	84		5	

TABLE A-107
LACK SPECIAL EQUIPMENT

	Hand Controls (N = 622)		Assorted Equipment (N = 26)	
	#	%	#	%
Yes	109	17.5	3	11.5
No	513	82.5	23	88.5
Missing Data	48		-	

TABLE A-108
SPECIAL EQUIPMENT LACKING

	Hand Controls (N = 102)		Assorted Equipment (N = 3)	
	#	%	#	%
Factory Options	31	29.8	1	33.3
Wheelchair Lift	16	15.4	-	-
Mobile Telephone/2-Way Radio	8	7.7	-	-
New Hand Controls	6	5.8	-	-
Remote Starter	4	3.8	-	-
Zero Effort Brakes and Acceleration	2	1.9	-	-
Other	35	35.6	2	66.7
Missing Data	568		23	

TABLE A-109
MATCHING OF EQUIPMENT USED WITH EQUIPMENT GENERALLY RECOMMENDED FOR SELECTED DISABILITIES

Disability	Equipment Generally Recommended	Equipment Users #	Equipment Users %	Non-Users #	Non-Users %
Left Leg Missing or Non-Functional (N = 8)	Automatic Transmission	7	87.5	1	12.5
	Parking Brake Extension or Hand Clutch	1	12.5	7	87.5
	Hand Dimmer Switch	3	37.5	5	62.5
Both Legs Missing or Non-Functional (N = 222)	Automatic Transmission	214	96.4	8	3.6
	Power Steering	206	92.8	16	7.2
	Power Brakes	208	93.7	14	6.3
	Hand Controls	184	82.9	38	17.1
	Parking Brake Extension	28	12.6	194	87.4
	Spinner Knob	34	15.3	188	84.5
	Two Door Sedan	135	60.8	87	39.2
	Hand Dimmer Switch	46	20.7	176	79.3
	6-Way Power Seat	45	20.3	177	79.7
	Removable Floor Insert Boards	7	3.2	215	96.8
	Transfer Aids	19	8.6	203	91.4
Short Legs (N = 24)	Pedal Extensions	1	4.2	23	95.8
	Hand Controls (possibly)	20	83.3	4	16.7
	Hand Dimmer Switch	4	16.7	20	83.3
	Parking Brake Extension	2	8.3	22	91.7
Both Arms and Both Legs - Low Level Quadriplegic (N = 57)	Automatic Transmission	54	94.7	3	5.3
	Hand Controls	42	73.7	15	26.3
	Hand Dimmer Switch	22	38.6	35	61.4
	Quad Steering Device	36	63.2	21	36.8
	Full range rear view mirror if neck rotation is limited				
	Two-door car	19	33.3	38	66.7
	Chest harness safety belt				
	Transfer Aids	9	15.8	48	84.2
	Side View Mirrors				
Both Arms and Both Legs - High Level Quadriplegic (N = 8)	Automatic Transmission	8	100.0	-	-
	Hand Controls	8	100.0	-	-
	Quad Steering Device	7	87.5	1	12.5
	Remote Dimmer Switch	4	50.0	3	37.5
	Electric Parking Brake	2	25.0	6	75.0
	Adjustable Steering Column	1	12.5	7	87.5
	Tilt Steering	5	62.5	3	37.5
	Modified Steering Wheel	3	37.5	5	62.5
	Low or Zero Effort Steering	2	25.0	6	75.0
	Emergency Steering Back-up	1	12.5	7	87.5
	Wheelchair Restraint	2	25.0	6	75.0
	Chest Harness Safety Restraint	5	62.5	3	37.5
	Power Pan or Wheel Channels	2	25.0	6	75.0
	Automatic Wheelchair Lift	6	75.0	2	25.0
	Raised Side Doors	1	12.5	7	87.5
	Raised Roof	3	37.5	5	62.5
	Air Conditioning	5	62.5	3	37.5
	Cruise Control	4	50.0	4	50.0
	Keyless Ignition	1	12.5	7	87.5
	Quad Console or Dash Control Extensions	2	25.0	6	75.0
	Power Window				
Small Body Size (N = 34)	Spinner Knob	15	44.1	19	55.9
	Extension on Dimmer Switch	7	20.6	27	79.4
	Parking Brake Extension	3	8.8	31	91.2
	Pedal Extensions or Hand Controls	24	70.6	10	29.4
	Dash Control Extensions	1	2.9	33	97.1
	Automatic Transmission	30	88.2	4	11.8
	Power Steering	30	88.2	4	11.8
	Power Brakes	30	88.2	4	11.8

TABLE A-110*
SPECIFIC PROBLEMS REPORTED WITH ADAPTIVE DRIVING AIDS

	Hand Controls Users with Problems #	Assorted Equipment Users with Problems #
STEERING AIDS		
Reduced Effort Steering	5	
- Steering still too difficult	(1)	
- Poor installation	(2)	
- Vacuum pump pressure leak	(1)	
Steering Column Adjuster	2	
- Not enough room in driver's compartment	(1)	
- Positioning of tilt steering interferes with use of hand controls	(1)	
Emergency Steering Backup	3	
- Electrical short	(1)	
Modified Steering	1	
- Difficult to turn with one hand	(1)	
Steering Spinner	23	3
- Hard to grip	(1)	
- Hard to replace	(4)	
- Knob on bottom of palm grip can lock steering wheel against hand controls	(1)	
- Hook steering spinner can prevent steering wheel from turning		(1)
- Catches on clothing	(3)	(1)
- Equipment failures (i.e. falls off during turns)	(6)	
- Too big for circumference of smaller cars	(2)	(1)
- Hard to remove and put on again	(4)	
- Not firm enough	(1)	
ACCELERATION/BRAKING AIDS		
Reduced Effort Acceleration/Braking	3	
- Poor installation	(1)	
Hand Controls	68	
- Difficult to operate secondary controls	(4)	
- Interferes with of operation of other controls	(10)	
- Lack of experienced installers and persons to service	(11)	
- Equipment failures (i.e. broken cotter pin)	(32)	
- Interferes with entry and exit	(12)	
- Able to brake and accelerate simultaneously	(7)	
Parking Brake Extention	12	
- Difficult to operate	(5)	
- Will not adapt to new vehicle	(1)	
- Poor material	(2)	
Electric Parking Brake	4	
- Poor installation	(3)	
Left Foot Gas Pedal	2	4
- Sticks in winter	(2)	(4)
Hand Clutch Control	1	
- Poorly installed	(1)	
- Equipment failure	(1)	
Pedal Extension		1
- Requires too much pressure to operate		(1)
VISION AIDS		
Right Side-Mounted Convex Rear View Mirrors	14	
- Impossible to adjust/ reach while driving	(6)	
- Hard to judge distance	(7)	
- Freezes in winter	(1)	
- Not large enough	(1)	

* Some respondents indicated that they had problems with a specific adaptive driving aid but did not describe problems.

TABLE A-110 (Cont'd)
SPECIFIC PROBLEMS REPORTED WITH ADAPTIVE DRIVING AIDS

	Hand Controls Users With Problems #	Assorted Equipment Users With Problems #
Left Side-Mounted Convex Rear View Mirror	8	
- Longer mirrors needed	(1)	
Full Range Rear View Mirror	1	
- Needs more mirrors	(1)	
Dual Mirrors	9	
- Moves out of adjustment	(4)	
- Need longer mirrors	(1)	
SAFETY AIDS		
Safety Torso Restraints/Chest Harness	21	3
- Too restrictive	(17)	(1)
- Not effective/driving hazard	(2)	
- Won't go around due to built up seat		(2)
Wheelchair Restraints	4	
- Adds too much extra weight to wheelchair	(1)	
- Clamps down in one place only - poor restraint	(1)	
Two-Way Radio	11	
- Portable - does not have good range	(4)	
- Entry/exit more difficult	(3)	
- Poor installation	(2)	
CONTROL LEVER AIDS		
Keyless Ignition	3	
- Poor installation and servicing	(3)	
Remote Starter	1	
- Poor installation	(1)	
Right Side Turn Signal	1	1
- Cannot weld to existing aluminum arm	(1)	(1)
Powered Gear Selector	2	
- Wiring problems	(2)	
Remote Secondary Controls	9	
- Difficult to install	(2)	
- Equipment failure	(3)	
- Difficult to reach	(4)	
Remote Dimmer Switch	11	
- Difficult to reach	(2)	
- Difficult to use while driving	(3)	
- Poor material	(1)	
- Wiring problems	(3)	
Dashboard Extensions/Rings	1	
- Homemade/inadequate	(1)	
Centre or Door Console	4	
- Centre consoles too high	(1)	
- Faulty wiring	(3)	
ENTRY/EXIT AIDS		
Automatic Swing or Sliding Doors	22	
- Equipment failure	(5)	
- Electrical problems	(4)	
- Freezes in cold weather	(3)	
- Lack of available mechanics	(5)	
- Constant service needed	(2)	
Automatic Lift	30	
- Broken cables/chain	(7)	
- Solinoids in lift are unpredictable	(7)	
- Electrical problems	(8)	
- Need two batteries for winter driving	(1)	
- Freezes in cold weather	(1)	
- Needs periodic adjustment	(1)	
- Lack of available service/maintenance	(5)	

TABLE A-110 (Cont'd)
SPECIFIC PROBLEMS REPORTED WITH ADAPTIVE DRIVING AIDS

	Hand Controls Users with Problems #	Assorted Equipment Users with Problems #
Removable Seat	1	
Track Seating	6	
- Track too short	(3)	
- Equipment failure	(1)	
Transfer Aids	1	
- Broken fiberglass transfer board	(1)	
Remote Control Doors and Lift	1	

APPENDIX B

PILOT STUDY

RESULTS OF PILOT STUDY

The pilot study was conducted using the same questionnaire as that sent to drivers requiring hand controls and assorted equipment. Questionnaires were sent to 130 drivers requiring automatic transmission and 100 drivers requiring outside rear view mirrors in an effort to identify whether these drivers also have special driving needs.

The response rate was 26% for the automatic transmission sample and 18% for the outside rear view mirrors sample. The lower response rates may be due to the fact that the questionnaire covered a broad range of disabilities and special equipment which many of these drivers did not find relevant to them. Therefore, the results of this pilot study are limited and indicate that a different questionnaire would be needed if a full study of these groups is carried out.

A number of respondents did, however, report using driving aids in addition to the equipment required by their licence restriction. The following is a brief summary of the disabilities and related equipment needs reported by respondents in the automatic transmission and the outside rear view mirrors samples.

B.1 Automatic Transmission Sample

Profile of Driver

The twenty-seven repondents in the automatic transmission sample reported having one or more of the following disabilities: amputation (14), polio (7), stiff joints (6), arthritis (5), shortness of body or limbs (2), heart condition (1), paraplegia (1) or a back/spine impairment (1).

Many (20) reported lower body limitations; 17 noted single leg disabilities and 3 indicated that both legs are affected. Most indicated that they have partial functioning of the lower body (14) while 5 reported no functioning at all. Limitations reported with respect to the lower body include: amputation (7), paralysis (5), muscle weakness (5), short limbs (4) and difficulty moving (2).

Nine respondents reported a limitation in one arm due to amputation (7), difficulty moving (1) or paralysis (1). In terms of severity, 5 reported having partial function of the arm and 2 reported having no function of the arm.

Use of the following assistive devices was noted: canes (10), crutches (7), leg/foot prosthesis (7), hand/arm prosthesis (5), special shoes (4), back brace (2), and wheelchair (2).

Adaptive Driving Aids and Driving Needs

The adaptive driving aids used by these drivers include: acceleration/braking aids such as left-foot gas pedal (5), and hand controls (2); vision aids such as left convex rear view mirror (5), right convex rear view mirror (4), full range rear view mirror (4), and dual mirrors (1); safety aids such as torso restraint/chest harness (5), two-way radio (1) and fire

extinguisher (1); control lever aids such as remote dimmer switch (2) and remote controls (1); and steering aids such as steering column adjuster (1).

Although none of the respondents felt that because of cost they lacked driving equipment that could help them with driving, the need for the following equipment was expressed: hand parking brake (1), left-foot gas pedal (1), hand controls (1), cruise control (1), right-side turn signal (1) and telescopic steering column (1).

B.2 Outside Rear View Mirrors Sample

Profile of Driver

Thirteen of the 15 respondents require outside rear view mirrors due to their being hard of hearing. Two respondents reported having arthritis and/or a back impairment. In both cases, both legs are affected and only partially functional.

Adaptive Driving Aids

Respondents indicated that they use the following adaptive driving aids: left convex rear view mirror (5), right convex rear view mirror (3), full range rear view mirror (2), right-side turn signal (1), remote controls (1), remote dimmer switch (1), dual mirrors (1) and torso restraint/chest harness (1). One respondent expressed the need for a reverse beeper.

B.3 Implications of Pilot Study

There are currently 2,216 drivers in Ontario who require automatic transmission and 727 who require outside rear view mirrors. A questionnaire designed to address their needs would be required in order to obtain a better understanding of the needs of these two groups, especially the automatic transmission group who require a range of equipment for a number of disabilities.

APPENDIX C

QUESTIONNAIRE

Ontario

Ministry of
Transportation and
Communications

1201 Wilson Ave., East Bldg.
Downsview, Ontario M3M 1J8

February 20, 1986

Dear Driver:

According to our calculations, approximately one in every 1,000 Ontario drivers requires special equipment to drive. Nobody is better able to tell us about the changes or improvements that should be made in the design of vehicles or special equipment than the people who use this equipment themselves.

This is your opportunity to provide us with this much needed information. We need to know more about consumers' travel and transportation needs, experiences driving with special equipment, and the different equipment needed for specific disabilities. This will better enable us to encourage the private sector in the development of vehicles and equipment to meet your needs and support the development of safety standards for such equipment.

To this end, we are enclosing a questionnaire which we would appreciate having you fill out. It is being sent to drivers whose licences indicate they require special equipment to drive. We have tried to make the questionnaire quicker and easier to complete by using checklists. It does appear lengthy because it covers a broad range of equipment needs, yet should only take about 20-25 minutes to complete. Instructions for completing the questionnaire are attached.

All information will be treated confidentially. There is no need to put your name on the questionnaire or enclosed envelope. This is an opportunity for you to tell us what changes you would like to see in the design of future vehicles and special driving equipment. Help us to understand and better address <u>your</u> needs, as well as those of others who have similar driving requirements.

Thank you. We appreciate your assistance.

Yours sincerely,

H.P. Kivi
Executive Director
Transportation Regulation Operations Division

Enclosures

INSTRUCTIONS FOR COMPLETING THE SURVEY

1. All answers will be treated confidentially. There is no need to put your name on the questionnaire or envelope.

2. It's important to answer all questions. There are no right or wrong answers; just answers that best describe your situation.

3. **Please return the completed questionnaire in the enclosed, self-addressed envelope within two weeks of receiving this.** No postage stamp is required. We will, of course, accept your response at any time. If you would like a copy of the report of the survey, please provide your address on the form below and return with the questionnaire or in a separate envelope.

4. If you need assistance, please contact Barbara Breston, Human & Social Factors Office, Strategic Policy Secretariat, Ministry of Transportation and Communications, East Building, 1201 Wilson Ave., Downsview, Ontario M3M 1J8.

SPECIAL REQUESTS/DEMANDES SPECIALES:

- If you need a telephone interview because you have problems writing, provide us with your telephone number on the form below and return in the enclosed envelope.

- Si vous préférez une version française de ce questionnaire, veuillez s'il vous plaît écrire votre adresse ci-dessous. La retournez avec l'envelope dans ce pacquet.

____ Telephone Interview
____ Une version française de ce questionnaire
____ Report of Results

ADDRESS/ADRESSE: _____

_____

_____

TELEPHONE: Area Code: (___) Telephone No: _____

Ministry of Transportation and Communications
Ontario

SURVEY OF LICENSED DRIVERS WHO REQUIRE SPECIAL EQUIPMENT

Your responses to this questionnaire will help us to better understand and address your driving needs as well as those of others who have similar driving requirements

For Office Use

I. YOUR TRAVEL AND TRANSPORTATION NEEDS

Any further improvements in the design of vehicles must take into account the travel and transportation needs of drivers

1. a) Do you drive your own vehicle or have regular access to one?

_____ Yes _____ No (If no, answer questions 1 (c) to 3 and then go to Section III "Choosing a Future Vehicle")

b) If yes, which of the following applies:

_____ Own my own vehicle and I am the only driver
_____ Own my own vehicle and primary driver
_____ Share ownership of vehicle
_____ Drive a vehicle owned by family friend
_____ Drive a company vehicle
_____ Lease/rent vehicle and I am the only driver
_____ Lease/rent vehicle and share with other drivers

c) If no, what prevents you from driving on a regular basis?

_____
_____
_____

2. a) Approximately, how many years have you been licensed to drive with special equipment?

_____ Years

b) Approximately, how many years have you actually been driving with special equipment?

_____ Years

c) How many years had you been driving before requiring special equipment?

_____ Years

3. Approximately, how many trips per month do you make using the following means of transportation: (the journey from home and back is counted as one trip)

	1-10 trips	11-20 trips	21-30 trips	over 30 trips	Not Applicable
Car/Van as driver	____	____	____	_____	_____
Car/Van as passenger	____	____	____	_____	_____
Special Transit For Disabled Persons	____	____	____	_____	_____
Public Transit	____	____	____	_____	_____
Taxi	____	____	____	_____	_____

4. a) Based on your own experience, how satisfied are you with the following:

SCALE

Very Satisfied = 1
Satisfied = 2
Dissatisfied = 3
Very Dissatisfied = 4
No Opinion = 5
Not Applicable = 9

(Please fill in spaces below with appropriate number)

Availability of "Handicapped Only" Designated Parking Spaces _____ 20
Enforcement of Parking Provisions for "Handicapped Drivers" _____ 21
Options for Parking the Vehicle _____ 22
Availability of Special Driver Training Programs for Disabled Drivers _____ 23
Quality of Special Driver Training Programs for Disabled Drivers _____ 24
Availability of Professional Assessment of Driving Ability and Needs _____ 25
Quality of Professional Assessment of Your Driving Ability and Needs _____ 26
Licensing Requirements and Procedures _____ 27
Availability of Vehicle Insurance _____ 28

b) Do you have any further comments or examples related to your experience driving a vehicle?

_____ 29
_____ 30
_____
_____

5. In the past year, approximately how many kilometers (miles) did you drive?

_____ 1 - 1,600 km (1 - 1,000 mi) 31
_____ 1,600 - 8,000 km (1,000 - 5,000 mi)
_____ 8,000 - 16,000 km (5,000 - 10,000 mi)
_____ 16,000 - 32,000 km (10,000 - 20,000 mi)
_____ over 32,000 km (over 20,000 mi)

6. Where do you do most of your daily driving? (Please check only one) 32

_____ Locally, within city/town/village where I live
_____ Between cities

7. For the most part, is it necessary for you to drive your own vehicle for any of the following reasons: 33

_____ Part of my job
_____ No other alternative transportation
_____ No other alternative but if there was, would still prefer to drive
_____ Other transportation available but prefer to drive
_____ Other: _____

8. a) Are you satisfied with licence plates with the disabled symbol? 34

_____ Yes _____ No _____ No Opinion _____ Not Eligible

b) If no, why not? 35

_____
_____
_____

9. a) Are you satisfied with special municipal parking permits? 36

_____ Yes _____ No _____ No Opinion _____ Not Eligible

b) If no, why not? 37

_____
_____
_____

II. YOUR CAR

The following questions refer to the motor vehicle you own or use most often

1. **Type:** _____ Passenger Car _____ Regular Van
_____ Station Wagon _____ Truck
_____ Mini Van _____ Other _____

38

39-42

Make: _____ **Model:** _____ **Year:** _____

43-44

Number of Doors (If Car): _____ 2 doors _____ 4 doors

45

Type of Side Doors (If Van):
_____ swing doors _____ sliding doors

46

Type of Driver's Seat: _____ Bench _____ Split Bench
_____ Bucket _____ Wheelchair

47

2. **Approximately, how long have you owned or driven this vehicle?**
_____ Years

48-49

3. **Does your vehicle have any of the following factory-installed options: (Please check as many as apply)**

_____ Automatic Transmission
_____ Power Steering
_____ Power Brakes
_____ Adjustable Seats
_____ Power Seats
_____ Power Windows
_____ Cruise Control
_____ Power Door Locks
_____ Power Trunk/Hatch Release
_____ Adjustable Length Steering Column
_____ Adjustable Tilt Steering Wheel
_____ Air Conditioning
Remote Adjustable Outside Mirrors
_____ Left
_____ Right
_____ Rear Window Defroster

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63
64

4. **Are there any design features of the vehicle you drive that fail to meet your needs or affect your ability to drive safely?**
_____ Yes _____ No

65-66

If yes, please describe:

_____

_____

_____

67
68

5. a) **Using the left column, please identify any structural conversions that were made to your vehicle. (Check as many as apply)**

Using the right column, check those structural conversions with which you have had problems.

Conversions	Problems
_____ Power Pan	_____
_____ Wheel Wells/Channels	_____
_____ Raised Roof	_____
_____ Dropped Floor	_____
_____ Raised Side Door	_____
_____ Other _____	_____
_____ None of the above (go to question 6)	

69
70
71
72
73
74
75

b) **For each structural conversion you have had problems with, describe the nature of the problem.**

_____

_____

_____

76-77
78-79

c) To what extent are you satisfied with the following:

SCALE

Very Satisfied = 1
Satisfied = 2
Dissatisfied = 3
Very Dissatisfied = 4
No Opinion = 5

Not Applicable = 9

(Please fill in spaces below with appropriate number.)

Safety of Structural Conversion(s)	_____	80
Service/Maintenance of Vehicle and Parts	_____	1
Quality of Work involved in Structural Conversion(s)	_____	2
Number of Contractors Available for Structural Conversion(s)	_____	3
Time Required to Arrange for Structural Conversion(s)	_____	4
Time Required to Complete Structural Conversion(s)	_____	5
Availability of Information on Structural Conversion(s)	_____	6
Cost of Structural Conversion(s)	_____	7

d) How old was the vehicle when the structural conversion(s) was made? 8

_____ New
_____ 1-3 years
_____ 4-5 years
_____ over 5 years

e) Who was responsible for the structural conversion(s)? 9

_____ Company Specializing in Vehicle Conversions
_____ Dealership
_____ Licensed Auto Mechanic
_____ Personal Contact (family/friend)
_____ Other _____

f) Where was the structural conversion done? 10

_____ Ontario, specify city _____
_____ Other province, specify _____
_____ U.S.A., specify state _____

11
12-13

6. Which of the following adaptive driving aids do you use:
(Please check as many as apply, using left column)

Using the right column, check any driving aids with which you have problems.

a) Steering	**Problems**	
_____ Reduced Effort Steering	_____	14
_____ Emergency Steering Backup	_____	15
_____ Steering Column Extension	_____	16
_____ Steering Column Adjuster	_____	17
_____ Modified Steering Wheel (angle or size)	_____	18
_____ Horizontal Steering	_____	19
_____ Spinner Knob, Tri-Pin, V-Grip, Hook, Palm Grip, etc.	_____	20
_____ Foot Steering Control	_____	21
_____ Other: _____	_____	22
_____ None of the above	_____	23

Describe the nature of the problem(s). 24-25

_____
_____ 26-27
_____

b) Accelerating/Braking: **Problems**

_____ Reduced Effort Braking/Acceleration _____ 28

_____ Hand Controls (Right Angle Push, Tiller Bar, Push-Pull, Twist-Push, Quad Hand Control) _____ 29

_____ Hand Clutch Control _____ 30

_____ Left-Hand Gear Selector _____ 31

_____ Gear Selector on Floor _____ 32

_____ Left Foot Gas Pedal _____ 33

_____ Pedal Extensions _____ 34

_____ Parking Brake Extension Levers _____ 35

_____ Electric Parking Brake _____ 36

_____ Other _____ _____ 37

_____ None of the Above _____ 38

Describe the nature of the problem(s). 39-40

_____

_____ 41-42

_____

_____

c) Control Levers: **Problems**

_____ Keyless Ignition _____ 43

_____ Remote Starter _____ 44

_____ Right Side Turn Signal Lever _____ 45

_____ Gear Selector Extension Lever _____ 46

_____ Powered Gear Selector _____ 47

_____ Remote Wiper/Washer, Horn, Turn Signals Headlights Control _____ 48

_____ Remote Dimmer Switch _____ 49

_____ Dashboard Extensions/Rings _____ 50

_____ Centre or Door Console _____ 51

_____ Other: _____ _____ 52

_____ None of the Above _____ 53

Describe the nature of the problem(s). 54-55

_____ 56-57

_____

_____

_____

d) Visibility: **Problems**

Side Mounted Convex Rear View Mirrors

_____ Right _____ 58

_____ Left _____ 59

_____ Full Range Rear View Mirror _____ 60

_____ Dual Mirrors _____ 61

_____ Other _____ _____ 62

_____ None of the Above _____ 63

Describe the nature of the problem(s).

_____ 64-65

_____

_____

_____

e) Safety: **Problems**

_____ Safety Torso Restraints/Chest Harness _____ 66
_____ Power/Manual Wheelchair Restraints _____ 67
_____ 2-Way Radio _____ 68
_____ Car Telephone _____ 69
_____ Fire Extinguisher _____ 70
_____ Other: _____ _____ 71
_____ None of the Above _____ 72

Describe the nature of the problem(s).

_____ 73-74
_____ 75-76
_____
_____

f) Entry/Exit: **Problems**

_____ Automatic Swing or Sliding Door(s) _____ 77
_____ Automatic Lift (Electric, Hydraulic, Mechanical) _____ 78
_____ Removable Seat Base _____ 79
_____ Track Seating _____ 80
_____ Transfer Aids (Sliding Board, Gutterhook, Helper Bar/Strap) _____ 1
_____ Remote Control Door/Lifts _____ 2
_____ Removable Floor Insert Boards _____ 3
_____ Other _____ _____ 4
_____ None of the above _____ 5

Describe the nature of the problem(s).

_____ 6-7
_____ 8-9
_____
_____

If you do not use any adaptive driving aids, go to question 7.

g) Who installed the adaptive driving aid(s) in your vehicle:

_____ Equipment Vendor 10
_____ Equipment Manufacturer 11
_____ Licensed Auto Mechanic
_____ Personal Contact (family/friend)
_____ Yourself
_____ Other _____

h) Where did you purchase the adaptive driving aid(s)?

_____ Ontario, specify city: _____ 12
_____ Other province, specify: _____
_____ U.S.A., specify state: _____ 13-14

i) Could the adaptive driving aids you currently use be readily disassembled and reused if you were to purchase another vehicle?

_____ Yes _____ No _____ Don't Know 15

j) To what extent are you satisfied with the following:

SCALE

Very Satisfied = 1
Satisfied = 2
Dissatisfied = 3
Very Dissatisfied = 4
No Opinion = 5

(Please fill in spaces below with appropriate number.)

Safety of Adaptive Driving Aid(s) _____ 16
Service/Maintenance of Equipment _____ 17
Quality of the Installation _____ 18
Number of Qualified Installers Available _____ 19
Time Required to Arrange for Installation(s) _____ 20
Time Taken to Install Adaptive Driving Aid(s) _____ 21
Availability of Information on Adaptive Driving Aids _____ 22
Cost of Adaptive Driving Aid(s) _____ 23

7. a) Do you lack any special equipment that could help you with driving because the cost is too high?

_____ Yes _____ No 24

b) If yes, please describe equipment that you lack:

_____
_____ 25
_____

8. a) Where did you obtain information on the available conversion(s) or adaptive driving aid(s) best suited to your driving needs? (Check as many as apply)

_____ Magazine Articles, Brochures 26
_____ Exhibitions
_____ Personal Contacts (family/friends) 27
_____ Professional Help (therapist, social worker, doctor) 28
_____ Information from a Special Organization
_____ Information from Manufacturer or Dealer
_____ Other _____
_____ Not Applicable

b) Do you have any suggestions for changes or improvements in vehicle: 29

Design – _____ 30
_____
_____

Structural Conversions – _____ 31
_____ 32
_____

Driving Aids – _____ 33
_____
_____ 34

9. Approximately, how much did it cost to purchase:

(a) vehicle: $_____ 35-39
(b) vehicle conversion(s): $_____ 40-43
(c) adaptive driving aids(s): $_____ 44-47
(d) vehicle insurance (1985): $_____ 48-51

10. a) Did you receive any mobility allowance or financial assistance to purchase and/or convert the vehicle?

_____ Yes _____ No _____ Not Applicable 52

b) If yes, please indicate source(s):

_____ Government Agency
_____ Private Insurance
_____ Private Sources (i.e family trust fund)
_____ Other (i e service clubs, community service organizations)

III. CHOOSING A FUTURE VEHICLE

The following questions are designed to provide you with an opportunity to identify the vehicle design features and options which would better meet your needs

1. **If you were in the market to buy a vehicle, describe what your preference would be, using the information provided below.**

a) Size:
_____ Subcompact Car
_____ Compact Car
_____ Intermediate Car
_____ Large Car
_____ Mini Van
_____ Regular Van
_____ Other _____

b) #Doors (If Car): _____ 2 door _____ 4 door

c) Type of Side Doors (If Van):
_____ swing doors _____ sliding doors

d) Driver's Seat: _____ Bucket _____ Bench
_____ Split Bench _____ Wheelchair

e) Factory Options (specify): _____
_____

f) Adaptive Driving Aids/Conversions: _____
_____
_____

g) What would you be willing to pay for the vehicle you have just described?
_____ under $10,000
_____ $10,000 - $14,999
_____ $15,000 - $19,999
_____ $20,000 - $24,999
_____ $25,000 - $29,999
_____ $30,000 or over

h) FOR WHEELCHAIR USERS ONLY:

Would you be willing to pay an additional amount to have a car which can be driven from a wheelchair and to which level access is possible without the use of a lift?
_____ Yes _____ No _____ Don't Know

Would you be willing to pay an additional amount for a van which can be driven from a wheelchair and to which level access is possible without the use of a lift or the need for a raised roof?
_____ Yes _____ No _____ Don't Know

2. **Do you think that you will be in the market to buy a new vehicle within:**

(Please check one)
_____ 1 year
_____ 2 years
_____ 3 years
_____ 4 to 5 years
_____ over 5 years
_____ Not Applicable

3. **What are the <u>three</u> most important features you would consider when choosing another vehicle?**

(Please indicate first (1), second (2), and third (3) choice)
_____ Appearance of Vehicle
_____ Wide Doors
_____ Height of Vehicle
_____ Head and Leg Room
_____ Size of Vehicle
_____ Ease of Entry/Exit
_____ Accessible Storage Space
_____ Seats
_____ Other: _____
_____

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58 59
60 61
62 63
64 65
66 67
68 69
70 71
72 73
74-75
76-77
78-79
1-2
3
4
5
6
7
8
9

4. a) If you were in the market to choose another vehicle, how interested might you be in considering each of the following options, assuming they were available and the costs were reasonable to you:

SCALE

Very Interested = 1
Interested = 2
Not Very Interested = 3
Not at all Interested = 4
No Opinion = 5

(Please fill in spaces below with appropriate number)

A vehicle that meets your driving needs and cannot be identified as a vehicle for disabled drivers _____ 10

A standard production vehicle which may be produced in the future, such as an electric car, for local, urban use only _____ 11

Shared ownership of a vehicle adapted to meet your driving needs _____ 12

The rental or leasing of a vehicle adapted to meet your driving needs _____ 13

b) Do you have any comments on any of the above options?

_____ 14

_____ 15

_____ 16

5. Do you have any suggestions or comments on how the design of vehicles can be improved to better meet your needs? 17

_____ 18

_____

_____ 19

IV. YOUR PHYSICAL ABILITY

The following questions are important in determining what specific types of driving equipment are required to meet the needs of varying levels of physical ability. Some of the questions will not apply to you as they cover a wide range of physical medical conditions. Please answer those questions which do apply.

1. Do you have any of the following disabilities? (Please check as many as apply) 20-21 22-23 24-25

_____ Stiff Joints
_____ Arthritis
_____ Heart Condition
_____ Parkinson's Disease
_____ Head Injury
_____ Shortness of Body or Limbs
_____ Muscular Dystrophy
_____ Stroke
_____ Multiple Sclerosis
_____ Amputation
_____ Paraplegia
_____ Triplegia
_____ Quadriplegia
_____ Hemiplegia
_____ Back Spine Impairment
_____ Cerebral Palsy
_____ Polio
_____ Spina Bifida
_____ Other _____

2. a) Do you have any limitation in your upper body? 26

_____ If no, (go to Question 3a)
_____ Yes, right side only
_____ Yes, left side only
_____ Yes, both sides

b) Please describe: (Check as many as apply) 27 28

_____ short limbs
_____ amputation
_____ difficulty moving
_____ paralysis
_____ coordination problems
_____ spasticity
_____ muscle weakness
_____ other _____

c) What part is affected?

_____ From the shoulder and below
_____ From the elbow and below
_____ From the wrist and below

29

d) How severe is the limitation?

_____ Partial functioning
_____ Non-functioning

30

3. a) Do you have any limitation in your lower body?

_____ No (If no, go to Question 4)
_____ Yes, right side only
_____ Yes, left side only
_____ Yes, both sides

31

b) Please describe: (check as many as apply)

32
33

_____ short limbs
_____ amputation
_____ difficulty in moving
_____ paralysis
_____ coordination problems
_____ spasticity
_____ muscle weakness
_____ other _____

c) What part is affected:

_____ From the hip down
_____ From the knee down
_____ From the ankle down

34

d) How severe is the limitation?

_____ Partial functioning
_____ Non-functioning

35

4. Is movement of your neck affected in any way?

_____ No
_____ Yes, limited neck movement
_____ Yes, unable to move neck

36

5. Is your balance affected?

_____ No
_____ Yes partly affected
_____ Yes, completely affected

37

6. Do you use any of the following assistive devices?

38-39

_____ crutch(es)
_____ cane(s)
_____ special shoe(s)
_____ foot or leg brace
_____ back brace
_____ walker
_____ manual wheelchair
_____ motorized wheelchair
_____ hand or arm prosthesis
_____ foot or leg prosthesis
_____ other: _____
_____ None of the above

40-41

42-43

V. BACKGROUND QUESTIONS ABOUT YOU

Your answers to the following questions will be combined with everyone else's answers in order to describe the group of respondents as a whole

1. _____ **Male** _____ **Female**

44

2. Identify the general location in which you currently reside:

45

_____ Urban, identify city: _____
_____ Suburban, identify suburb: _____
_____ Rural, identify county: _____

46-47

3. Into which age group do you fall:

_____ 15-24 years _____ 45-54 years
_____ 25-34 years _____ 55-64 years
_____ 35-44 years _____ 65 years and over

48

4. a) Which of the following best describes your current employment status:

49

_____ Student _____ Unable to work
_____ Working full-time _____ Retired
_____ Working part-time _____ Other: _____
_____ Not currently employed

b) If employed, do you work outside of the home?

50

_____ Yes _____ No

5. Which would best describe your present living arrangement:

_____ Live alone
_____ Live with spouse/partner
_____ Live with relatives
_____ Live in shared or group accommodation
_____ Other: _____

51

6. What level of education have you completed:

52

_____ Grade 8 or less
_____ High School Degree or less
_____ College/Technical Degree or less
_____ University Degree or less
_____ Post Graduate Degree

7. Which of the following best describes your total annual household income before taxes:

53

_____ Under $10,000 _____ $30,000 - $39,999
_____ $10,000 - $19,999 _____ $40,000 or more
_____ $20,000 - $29,999

Having completed this survey, do you have any further comments or suggestions?

54

55

56

THANK YOU FOR YOUR PARTICIPATION!!